QUALITY ASSURANCE PROJECT PLAN
DIAMOND ALKALI – DIOXIN INVESTIGATION

Revision 3

Prepared for:
United States Environmental Protection Agency/Environmental Response Team
Edison, New Jersey

By:
Lockheed Martin/Scientific, Engineering, Response and Analytical Services
Work Assignment Number: SERAS-222

Based on the Intergovernmental Data Quality Task Force Uniform
Federal Policy for Quality Assurance Project Plans
(Final Version 1.1, June 2006)

May 28, 2015

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Title and Approval Page

Site Name/Project Name: Diamond Alkali – Dioxin Investigation
Site Location: Newark, New Jersey (NJ)

Document Title: Diamond Alkali – Dioxin Investigation Quality Assurance Project Plan (QAPP)

Lead Organization: Environmental Protection Agency/Environmental Response Team (EPA/ERT)

Preparer's Name and Organizational Affiliation: Deborah A. Killeen, Lockheed Martin (LM) /Scientific, Engineering, Response and Analytical Services (SERAS)

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Preparation Date (Day/Month/Year): 05/28/15

Investigative Organization's Project Manager/Date: 6/19/15
Signature
Printed Name/Organization: Stephen Blaze/ERT Work Assignment Manager

Investigative Organization's Project QA Officer/Date:
Signature
Printed Name/Organization: David Charters/OSRTI Quality Assurance Manager

Lead Organization's Project Manager/Date:
Signature
Printed Name/Organization: Christopher Gussman/SERAS Task Leader

Approval Signatures/Date: 5/28/15
Signature
Printed Name/Title: Deborah Killeen/SERAS QA/QC Officer

Approval Authority: SERAS

Other Approval Signatures/Date 3/5/15
Signature
Printed Name/Title: Kevin Taylor/SERAS Program Manager

Document Control Numbering System: SERAS-222-DQAPPR3-052815

QAPP Worksheet #2
QAPP Identifying Information

Site Name/Project Name: Diamond Alkali – Dioxin Investigation
Site Location: Newark, NJ
Site Number/Code:
Operable Unit:
Contractor Name: Lockheed Martin
Contractor Number: EP-W-09-031

Contract Title: SERAS
Work Assignment Number: SERAS-222

1. Identify regulatory program: Comprehensive Environmental Response and Compensation Liability Act (CERCLA)
2. Identify approval entity: EPA/ERT
3. The QAPP is (select one): ☐Generic ☒Project Specific
4. List dates of scoping sessions that were held: 9/4/2013, 9/6/2013, 9/12/2013, 9/23/2013, 10/21/13 and 07/02/14
5. List dates and titles of QAPP documents written for previous site work, if applicable:

Title	Approval Date
Uniform Federal Policy-Quality Assurance Project Plan (UFP-QAPP) , SERAS document #SERAS-222-DQAPP-111213	11/18/13
UFP-QAPP – Revision 1, SERAS document #SERAS-222-DQAPPR1-011014	01/14/14
UFP-QAPP – Revision 2, SERAS document #SERAS-222-DQAPPR2-012114	01/21/14

6. List organizational partners (stakeholders) and connection with lead organization:
   EPA Region 2 (R2)
7. List data users:
   EPA Region 2
8. If any required QAPP elements and required information are not applicable to the project, then circle the omitted QAPP elements and required information on the attached table. Provide an explanation for their exclusions below:

QAPP Worksheet #2
QAPP Identifying Information
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QAPP Worksheet #2
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☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #3 (Summer 2015 Mobilization)
Distribution List

QAPP Recipients	Title	Organization	Telephone Number	Fax Number	E-mail Address	Document Control Number
Stephen L. Blaze	Work Assignment Manager (WAM) (Primary)	ERT	732-906-6921	732-321-6724	Blaze.Stephen@epa.gov	SERAS-222-DQAPPR3-040315
Mark Sprenger	WAM (Secondary)	ERT	732-906-6826	732-321-6724	Sprenger.Mark@epa.gov	SERAS-222-DQAPPR3-040315
Tom Kady	WAM (Secondary)	ERT	732-906-6172	732-321-6724	Kady.Thomas@epa.gov	SERAS-222-DQAPPR3-040315
Christopher Gussman	Environmental Scientist (Phytoremediation)/Task Leader (TL)	SERAS	732-321-4237	732-494-4021	christopher.d.gussman@lmco.com	SERAS-222-DQAPPR3-040315
Deborah Killeen	Quality Assurance/Quality Control (QA/QC) Officer	SERAS	732-321-4245	732-494-4021	deborah.a.killeen@lmco.com	SERAS-222-DQAPPR3-040315
Kevin Taylor	Program Manager	SERAS	732-321-4202	732-494-4021	kevin.c.taylor@lmco.com	SERAS-222-DQAPPR3-040315
David Charters	Office of Superfund Remediation and Technology Innovation (OSRTI) QA Manager	ERT	732-906-6825	732-321-6724	Charters.DavidW@epa,.gov	SERAS-222-DQAPPR3-040315
Eugenia Naranjo	Remedial Project Manager (RPM)	EPA R2	212-637-3467	NA	Naranjo.Eugenia@epa.gov	SERAS-222-DQAPPR3-040315

☐ Worksheet Not Applicable (State Reason)

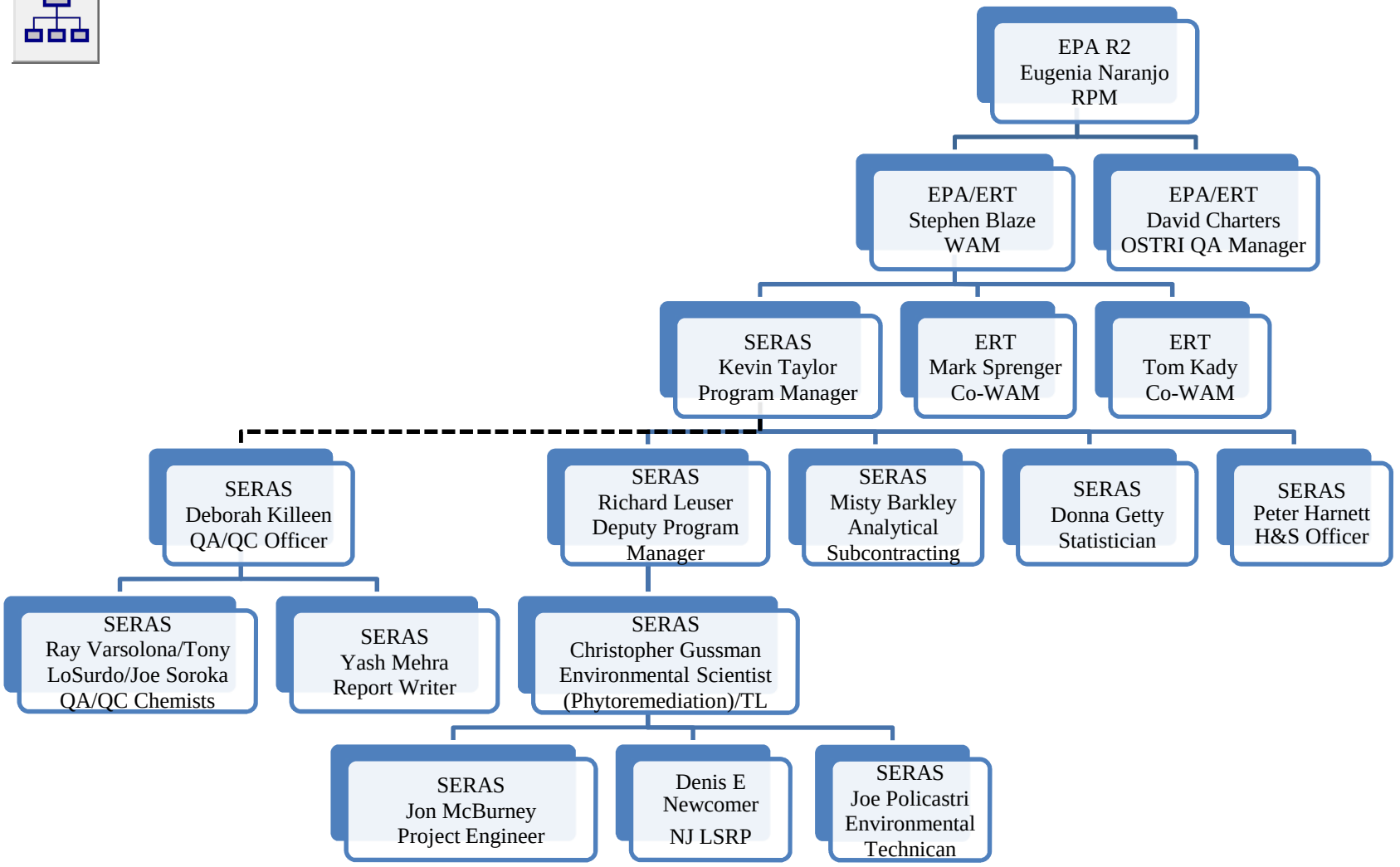
QAPP Worksheet #4 (Summer 2015 Mobilization)
Project Personnel Sign-Off Sheet

Organization: ERT/SERAS

Project Personnel	Title	Telephone Number	Signature	Date QAPP Read
Stephen Blaze	ERT WAM (Primary)	732-906-6921		8/13/15
Mark Sprenger	ERT WAM (Secondary)	732-906-6826		
Tom Kady	ERT WAM (Secondary)	732-906-6172		8/12/15
Christopher Gussman	SERAS Environmental Scientist (Phytoremediation)/TL	732-321-4237		
Eugenia Naranjo	EPA R2 RPM	212-637-3467		8-12-15
Jonathan McBurney	SERAS Project Engineer	732-321-4244		
Denis E Newcomer	NJ Licensed Site Remediation Specialist (LSRP)	215-230-8282		8·13·15
Joseph Policastri	SERAS Environmental Technician	732-321-4265		8-12-15
Chris French				8/12/15
Rich Magan	ENVIR TECH	732-691-7114		8/12/15

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #5 (Summer 2015 Mobilization)
Project Organizational Chart



☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #6
Communication Pathways

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Approval of initial QAPP and any amendments	ERT WAM OSRTI QA Manager SERAS Program Manager SERAS QA/QC Officer SERAS TL	Stephen Blaze David Charters Kevin Taylor Deborah Killeen Christopher Gussman	(732) 906-6921 (732) 906-6825 (732) 494-4202 (732) 321-4245 (732) 321-4237	SERAS internal peer review, followed by ERT approval, implementation of changes effective only with approved QAPP or QAPP Change Form.
Nonconformance and Corrective Action	SERAS TL ERT WAM SERAS QA/QC Officer	Christopher Gussman Stephen Blaze Deborah Killeen	(732) 321-4237 (732) 906-6921 (732) 906-6929	Use of the Work Assignment Field Change Form for field issues.
Posting of Deliverables to the ERT-Information Management System (IMS) website	SERAS TL SERAS QA/QC Officer SERAS Deputy Program Manager SERAS Administrative Support	Christopher Gussman Deborah Killeen Richard Leuser Eileen Ciambotti	(732) 321-4237 (732) 321-4245 (732) 494-4060 (732) 321-4255	As per work assignment, posting of deliverables to ERT-IMS website constitutes delivery to the WAM.
Work Assignment	SERAS Program Manager SERAS TL	Kevin Taylor Christopher Gussman	(732) 494-4202 (732) 321-4237	Describes scope of work to SERAS personnel from the ERT WAM.
Contract/Purchasing Communications	SERAS TL SERAS Analytical Subcontracting	Christopher Gussman Misty Barkley	(732) 321-4237 (732) 321-4205	SERAS TL will communicate with Contract/Purchasing Liason
Health & Safety	SERAS TL	Christopher Gussman	(732) 321-4237	Site Health & Safety Meeting

QAPP Worksheet #7 (Summer 2015 Mobilization)
Personnel Responsibilities and Qualification Table

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Christopher Gussman	Environmental Scientist (Phytoremediation)/TL	SERAS	TL, Project Supervision, Field Sampling, Reporting, Document Preparation/Site Visit	Minimum B.S. degree plus 8 years of related experience/Lockheed Martin Employee Files
Jon McBurney	Project Engineer	SERAS	Field Sampling Activities	Minimum B.S. degree plus 14 years of related experience/Lockheed Martin Employee Files
Deborah Killeen	QA/QC Officer	SERAS	Quality Assurance/Validation Oversight and Deliverable Review/QAPP Preparation/Site Visit	Minimum B.S. degree plus 14 years of related experience/Lockheed Martin Employee Files
Ray Varsolona	QA/QC Chemist	SERAS	Data Validation	Minimum B.S. degree plus 8 years of related experience/Lockheed Martin Employee Files
Tony LoSurdo	QA/QC Chemist	SERAS	Data Validation	Minimum B.S. degree plus 8 years of related experience/Lockheed Martin Employee Files
Yash Mehra	Report Writer	SERAS	Report & EDD Preparation	Minimum B.S. degree plus 8 years of related experience/Lockheed Martin Employee Files
Joseph Soroka	QA/QC Chemist	SERAS	Data Validation	Minimum B.S. degree plus 8 years of related experience/Lockheed Martin Employee Files
Misty Barkley	Subcontract Laboratory Liaison	SERAS	Subcontract Laboratory Communications	Minimum B.S. degree plus 8 years of related experience/Lockheed Martin Employee Files
Donna Getty	Statistician	SERAS	Historical Data Review/Sampling Design	Minimum B.S. degree plus 8 years of related experience/Lockheed Martin Employee Files
Stephen Blaze	WAM	EPA/ERT	Technical Direction/Oversight	EPA Job-related qualifications/EPA Files
David Charters	QA Manager	OSRTI	QA Oversight	EPA job-related qualifications/EPA Files
Eugenia Naranjo	RPM	EPA	Project Oversight	EPA job-related qualifications/EPA Files
Mark Sprenger	Co-WAM	EPA/ERT	Technical Direction/Oversight	EPA Job-related qualifications/EPA Files
Tom Kady	Co-WAM	EPA/ERT	Technical Direction/Oversight	EPA Job-related qualifications/EPA Files
Denis E Newcomer	NJ LSRP	NA	Certification of Waste Cell Repair and Integrity	NJ Certificate of License #582602
Joe Policastri	Environmental Technician	SERAS	Field Sampling Activities	Experience in Environmental Sampling/Lockheed Martin Employee Files

QAPP Worksheet #8 (Summer 2015 Mobilization)
Special Personnel Training Requirements Table

Project Function	Specialized Training – Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/ Organizational Affiliation	Location of Training Records/Certificates
Project Oversight	Health & Safety Training	SERAS	Nov 2014	Christopher Gussman	Environmental Scientist (Phytoremediation)/TL/ SERAS	SERAS H&S Files
Field Activities	Health & Safety Training	SERAS	Dec 2014	Jonathan McBurney	Project Engineer/SERAS	SERAS H&S Files
Site Visit	Health & Safety Training	SERAS	Oct 2014	Deborah Killeen	QA/QC Officer/SERAS	SERAS H&S Files
Validation Support	Annual Data Integrity Training/Peak Integration Training	SERAS	Feb/Mar 2015	Raymond Varsolona Tony Losurdo Joe Soroka	QA/QC Chemist/SERAS	SERAS Quality Files
Validation Support	Annual Data Integrity Training/Peak Integration Training	SERAS	Feb 2015	Yash Mehra	Report Writer/SERAS	SERAS Quality Files
QA Oversight	Data Review & Validation	Laboratory Data Consultants	Jan 2007	Deborah Killeen	QA/QC Officer/SERAS	SERAS Quality Files
QA Oversight	Uniform Federal Policy for Quality Assurance Project Plans	Advanced Systems	Jan 2006	Deborah Killeen	QA/QC Officer/SERAS	SERAS Quality Files
Field Activities	Health & Safety Training	SERAS	Jun 2014	Joe Policastri	Environmental Technician/SERAS	SERAS H&S Files

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #9-1
Project Scoping Session Participants Sheet

Project Name: Diamond Alkali – Dioxin Investigation **Projected Date(s) of Sampling:** TBD **Project Manager:** Christopher Gussman	**Site Name:** Diamond Alkali – Dioxin Investigation **Site Location:** Newark, NJ

Date of Session: 09/04/2013
Scoping Session Purpose: Answer questions regarding task and establish sampling/analytical strategies

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Marc S. Greenberg	WAM	ERT	732-452-6413	Greenberg.Marc@epa.gov	Project Technical Direction
Dennis Miller	Program Manager	SERAS	732-321-4216	dennis.a.miller@lmco.com	Contract oversight
Misty Barkley	Property Coordinator	SERAS	732-321-4205	misty.barkley@lmco.com	Analytical Subcontracting
Richard Leuser	Deputy Program Manager	SERAS	732-494-4060	richard.m.leuser@lmco.com	Project Review
Deb Killeen	QA/QC Officer	SERAS	732-321-4245	deborah.a.killeen@lmco.com	QA/Validation Oversight/QAPP Preparation
Donna Getty	Statistician	SERAS	732-321-4274	donna.j.getty@lmco.com	Statistical/sampling design support
Mark Sprenger	WAM	ERT	732-906-6826	Sprenger.Mark@epa.gov	Technical Support
Christopher Gussman	Environmental Scientist (Phytoremediation)/TL	SERAS	732-321-4237	christopher.d.gussman@lmco.com	Task Leader/Project Oversight & Coordination
Tim Kubiak	Supervisory Fish & Wildlife Biologist	USFWS	609-383-3938 x26	Tim_Kubiak@fws.gov	Technical Support

Comments/Decisions: Givaudan manufactured flavors, fragrances, and specialty chemicals such as pharmaceutical intermediates and pesticides, at a facility in Clifton, NJ and ceased operations in 1998. Trichlorophenol was used at the Givaudan facility in the production of hexachlorophene (HCP). 1,2,4,5,7,8-hexachloroxanthene (HCX) has also been associated with the production of HCP. Between 1951 and 1969, the Diamond Alkali Company operated a facility at 80 Lister Avenue, in Newark, New Jersey, manufacturing pesticides and phenoxy herbicides. Among other chemicals, the company manufactured 2,4,5-trichlorophenoxy acetic acid (2,4,5-T), a by-product of which is 2,3,7,8-tetrachlorodibenzodioxin (TCDD). Production activities at the Diamond Alkali facility ceased in August 1969.

Sediment samples collected in 2011 in the vicinity of RM 10.9 showed elevated concentrations of 2,3,7,8-TCDD and other contaminants at the surface. The age of the surface dates back to 1960. To evaluate Givaudan' s potential as a source of dioxin, and to evaluate and compare with the contribution of dioxin from the Diamond Alkali facility, HCP, HCX and 2,4,6,8-tetrachlorodibenzothiophene (TCDT) are compounds of interest in addition to the 12-dioxin-like congeners, 17 dioxins/furans and total polychlorinated biphenyls (PCBs) as Aroclors.

According to the USFWS, HCP, HCX and 2,3,7,8-TCDT are available from Cambridge Isotope (isotope.com) on pages 165, 181 and 206. United States Geological Survey (USGS) and USEPA analytical chemists have expertise with some or all of these compounds. For example, the EPA Region 1 Narragansett Lab has expertise with HCX and TCDT.

The areas of focus for sampling are: 1) River at mudflat both core and surface – surface is defined as the top 6 inches (″); 2) Waste cell on Givaudan Property – 3-5 feet (') in depth and 3) Waste cell on Diamond Alkali property – 3-5' in depth. EPA would like to oversample side-by-side cores, if possible.

EPA would like us to get out there before the current USEPA removal action that includes dredging and capping is complete. The project decision statement should reflect the presence/absence of analytes and the ratios of the varoius analytes. Typical QC samples (field duplicates, matrix spikes/matrix spike duplicates [MS/MSDs], etc.) will be inserted into the sample stream.

Action Items: SERAS will continue working with the labs to determine the feasibility of getting HCP, HCX and 2,4,6,8-TCDT analyzed. EPA will set up conference calls with USGS and then with the Narragansett lab to give us some insight into the extraction and analysis procedures.

UPDATE: The first paragraph at the top of this page has been modified to "Sediment samples collected in 2011 in the vicinity of RM 10.9 showed elevated concentrations of 2,3,7,8-TCDD and other contaminants at the surface. The age of the surface dates back to 1960. To evaluate Givaudan' s potential as a source of dioxin, and to evaluate and compare with the contribution of dioxin from the Diamond Alkali facility, HCP and HCX (identified with production processes at Givaudan) and TCDT (identified with production processes at Diamond Alkali) are compounds of interest in addition to the 12-dioxin-like congeners, 17 dioxins/furans and total polychlorinated biphenyls (PCBs) as Aroclors." It must be noted that modification of this sentence is at the request of Givaudan (1/27/14) and was not recorded/documented as stated during the scoping meeting held on 9/4/13.

QAPP Worksheet #9-2
Project Scoping Session Participants Sheet

Project Name: Diamond Alkali – Dioxin Investigation **Projected Date(s) of Sampling:** TBD **Project Manager:** Christopher Gussman	**Site Name:** Diamond Alkali – Dioxin Investigation **Site Location:** Newark, NJ
Date of Session: 09/06/2013 **Scoping Session Purpose:** Answer questions on analytical methodologies for TCDT.	

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Marc S. Greenberg	WAM	ERT	732-452-6413	Greenberg.Marc@epa.gov	Project Technical Direction
Dennis Miller	Program Manager	SERAS	732-321-4216	dennis.a.miller@lmco.com	Contract Oversight
Misty Barkley	Property Coordinator	SERAS	732-321-4205	misty.barkley@lmco.com	Analytical Subcontracting
Deb Killeen	QA/QC Officer	SERAS	732-321-4245	deborah.a.killeen@lmco.com	QA/Validation Oversight/QAPP Preparation
Christopher Gussman	Environmental Scientist (Phytoremediation)/TL	SERAS	732-321-4237	christopher.d.gussman@lmco.com	TL/Project Oversight & Coordination
Tim Kubiak	Supervisory Fish & Wildlife Biologist	USFWS	609-383-3938 x26	Tim_Kubiak@fws.gov	Technical Support
Paul Peterman	Chemist	USGS	573-876-1830	ppeterman@usgs.gov	Technical Support
Kathy Echols	Research Chemist	USGS	573-876-1838	kechols@usgs.gov	Technical Support
Raymond Varsolona	QA/QC Chemist	SERAS	732-494-4054	raymond.a.varsolona@lmco.com	Validation Support

Comments/Decisions: The reaction pathway leading to the formation of TCDT from PCBs with sulfur is similar to the reaction pathway leading to the formation of tetra chlorinated dibenzofurans (CDFs) from PCBs with oxygen. 2,3,7,8-Tetrachlorodibenzothiophene is available from Cambridge Isotope. Jan Anderson at the University of Muenster has several dibenzothiophenes that would be helpful to determine where the peaks are. TCDT was analyzed using high resolution gas chromatography/high resolution mass spectrometry (HRGC/HRMS) using a DB-5MS column in the selective ion monitoring (SIM) mode. In the Group 2 window, 95 percent (%) of the tetrachlorothiophenes elute with the penta dioxins/furans. The penta window needs to be stretched to see 2,3,7,8-TCDT otherwise it may be missed. 2,4,6,8-TCDT is one of the early eluters in the window (1/4 to 1/5 of the Group 2 window). An average response factor (RF) of 1 was assigned for the 2,4,6,8-TCDT (Refer to the Tracy *et al* and the Peterman *et al* references listed in Worksheet 13)

The standard extraction method for dioxins/furans was used. For the carbon cleanup separation, the lab should collect both fractions to make sure that this compound isn't missed (i.e., retain the eluate that removes the interfering compounds in section 13.5.4 of EPA Method 1613B prior to inverting the column and eluting the TCDDs/TCDFs with toluene)

There are several papers from the proceedings of the dioxin meetings (dioxin20xx.org) that can be referred to. Extraction and analysis of HCX by Karen Tracy, Battelle, Columbus, Ohio in 2003, go to organohalogen compounds 560, pp177-180. For chromatography of TCDT, see Peterman 2006, Enhanced Chemistry of Dibenzothiophenes, Figure 1 or Figure 2. This links HCX from HCP. Table 1 shows a 50% degradation of HCX in 30 days in nonane only. Table 2 shows the calibration curves. HCX survives the 1613 extraction method (hexa to hepta).

HCP is an inexpensive standard that can be obtained from Sigma. Beller 1988 demonstrated a relatively long half-life for this compound. Allard in 1959 indicated that HCP is quite resistant to change. EPA Method 8270 would work better if it was a derivatization method.

Action Items: SERAS will relay this information to the laboratories that may potentially perform work.

QAPP Worksheet #9-3
Project Scoping Session Participants Sheet

Project Name: Diamond Alkali – Dioxin Investigation **Projected Date(s) of Sampling:** TBD **Project Manager:** Christopher Gussman	**Site Name:** Diamond Alkali – Dioxin Investigation **Site Location:** Newark, NJ

Date of Session: 09/06/2013
Scoping Session Purpose: Answer questions on sampling/analytical strategies

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Misty Barkley	Property Coordinator	SERAS	732-321-4205	misty.barkley@lmco.com	Analytical Subcontracting
Christopher Gussman	Environmental Scientist (Phytoremediation)/TL	SERAS	732-321-4237	christopher.d.gussman@lmco.com	Task Leader/Project Oversight & Coordination
Raymond Varsolona	QA/QC Chemist	SERAS	732-494-4054	raymond.a.varsolona@lmco.com	Validation Support
Martha Maier	Laboratory Director	Vista	916-673-1520	mmaier@vista-analytical.com	Analytical Support
Andrew Patterson	Technical Director	Vista	916-673-1520	apatterson@vista-analytical.com	Analytical Support

Comments/Decisions: Updates: Ultra Scientific is trying to synthesize 2,4,6,8-TCDT. Cambridge Isotope would synthesize the compound along with a labeled compound in approximately 4 to 6 weeks.

The lab stated that they seem to have better recovery for HCX and TCDT if they modify the EPA Method 1613 extraction. HCX and 2,4,6,8-TCDT would be analyzed together by high resolution mass spectrometry separate from the dioxins. HCP would be analyzed by liquid chromatography/mass spectrometry (LC/MS).

Ray recommended a labeled 2,4,6,8-TCDT due to possible co-elution with 1,2,8,9-TCDD. This would also give a final concentration based on the recovery of the labeled standard.

UPDATE (11/13/13): A labeled and unlabeled source of 2,4,6,8-TCDT will be purchased from Cambridge Isotopes.

QAPP Worksheet #9-4
Project Scoping Session Participants Sheet

Project Name: Diamond Alkali – Dioxin Investigation **Projected Date(s) of Sampling:** TBD **Project Manager:** Christopher Gussman	**Site Name:** Diamond Alkali – Dioxin Investigation **Site Location:** Newark, NJ

Date of Session: 09/12/2013
Scoping Session Purpose: Answer questions on sampling/analytical strategies

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Marc S. Greenberg	WAM	ERT	732-452-6413	Greenberg.Marc@epa.gov	Project Technical Direction
Misty Barkley	Property Coordinator	SERAS	732-321-4205	misty.barkley@lmco.com	Analytical Subcontracting
Deb Killeen	QA/QC Officer	SERAS	732-321-4245	deborah.a.killeen@lmco.com	QA/Validation Oversight/QAPP Preparation
Christopher Gussman	Environmental Scientist (Phytoremediation)/TL	SERAS	732-321-4237	christopher.d.gussman@lmco.com	Task Leader/Project Oversight & Coordination
Tim Kubiak	Supervisory Fish & Wildlife Biologist	USFWS	609-383-3938 x26	Tim_Kubiak@fws.gov	Technical Support
Richard Pruell	Chemist	EPA R1	401-782-3091	Pruell.Richard@epa.gov	Technical Support
Bryan Taplin	Chemist	EPA R1	401-782-9607	Taplin.Bryan@epa.gov	Technical Support
Raymond Varsolona	QA/QC Chemist	SERAS	732-494-4054	raymond.a.varsolona@lmco.com	Validation Support
Eugenia Naranjo	RPM	EPA R2	212-637-3467	Naranjo.Eugenia@epa.gov	Project Oversight

Comments/Decisions: EPA started off the meeting stating that this investigation will be forensic to determine if other PRPs may have contributed to part of the contamination.

EPA R1 personnel stated that they didn't necessarily look for HCX but found it in the dioxin analysis. 2,4,6,8-TCDT can be found in the same fraction as dioxins. HCX is a by-product that is more dominant in the HCP process than 2,3,7,8-TCDD. EPA R1 stated that the use of Dionex solid phase extraction (SPE) may be better than Soxhlet extraction.

QAPP Worksheet #9-5
Project Scoping Session Participants Sheet

Project Name: Diamond Alkali – Dioxin Investigation **Projected Date(s) of Sampling:** TBD **Project Manager:** Christopher Gussman	**Site Name:** Diamond Alkali – Dioxin Investigation **Site Location:** Newark, NJ

Date of Session: 09/23/2013
Scoping Session Purpose: Answer questions on sampling/analytical strategies

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Marc S. Greenberg	WAM	ERT	732-452-6413	Greenberg.Marc@epa.gov	Project Technical Direction
Misty Barkley	Property Coordinator	SERAS	732-321-4205	misty.barkley@lmco.com	Analytical Subcontracting
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Christopher Gussman	Environmental Scientist (Phytoremediation)/TL	SERAS	732-321-4237	christopher.d.gussman@lmco.com	Task Leader/Project Oversight & Coordination

Comments/Decisions: Marc stated that we will go ahead with the HCP and the HCX analyses and not the TCDT. Unlabeled and labeled HCP and unlabeled HCX will be used for analysis (what is available). We are looking at 0-2 foot and 2-4 foot intervals for analysis.

Dredging will be completed by October 2, 2013. Stephanie Vaughn (RPM for removal action) will be sending a dredging map. There may be some areas that we will be able to sample.

EPA needs a cost estimate today from SERAS that includes everything (method development, calibration, analysis and method detection limit costs) so he can provide this estimate to the Region.

Action Items: SERAS will supply costs to EPA this afternoon by 3pm (Completed).

UPDATE: Field activities will occur as soon as possible. Two cores will be taken from the dredge zone, 2 cores from cut 5 or 6 (after dredging) and 2 cores from the zone outside of the removal area boundary. Approximately 12 to 15 samples will be collected along with one field duplicate.

UPDATE: Since a source of the labeled and unlabeled 2,4,6,8-TCDT standard is now available, analysis of TCDT will be pursued.

QAPP Worksheet #9-6
Project Scoping Session Participants Sheet

Project Name: Diamond Alkali – Dioxin Investigation **Projected Date(s) of Sampling:** TBD **Project Manager:** Christopher Gussman	**Site Name:** Diamond Alkali – Dioxin Investigation **Site Location:** Newark, NJ

Date of Session: 10/21/13
Scoping Session Purpose: Answer questions on sampling/analytical strategies

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Marc S. Greenberg	WAM	ERT	732-452-6413	Greenberg.Marc@epa.gov	Project Technical Direction
Misty Barkley	Property Coordinator	SERAS	732-321-4205	misty.barkley@lmco.com	Analytical Subcontracting
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Christopher Gussman	Environmental Scientist (Phytoremediation)/TL	SERAS	732-321-4237	christopher.d.gussman@lmco.com	Task Leader/Project Oversight & Coordination
Donna Getty	Statistician	SERAS	732-321-4274	donna.j.getty@lmco.com	Sampling Design

Comments/Decisions: Capping operations began on 10/28/13. The initial sampling design was scoped as follows: Would like 6 cores in the Passaic River up to 16 samples and one field duplicate. Cesium-137 and beryllium-7 analyses need to be conducted to see recent and historic sediment depositions. Sediment (one core) from each of the areas (no-dredge, downstream of the Removal Area and at the Third River) needs to be dated. Sampling in the river is tentatively due to occur the week of 11/11/13. Six samples will be collected from each of the waste cells located on the Givaudan and Diamond Alkali properties during a subsequent mobilization.

Action Items: SERAS needs to look at the historical data and see where the highest concentrations of contaminants have been found and propose sampling locations and revisions to the initial sampling design.

UPDATE: Field Activities will occur the week of 11/18/13. Add an additional location at the Dundee Dam, upstream of the Third River. There will be a total of 13 locations (4 in the non-dredge zone, 3 in the downstream of Removal Area zone, 2 at the Passaic and Third Rivers confluence, 3 in the Third River and one upstream reference location).

QAPP Worksheet #9-7
Project Scoping Session Participants Sheet

Project Name: Diamond Alkali – Dioxin Investigation **Projected Date(s) of Sampling:** Summer/Fall 2014 **Project Manager:** Christopher Gussman	**Site Name:** Diamond Alkali – Dioxin Investigation **Site Location:** Newark, NJ
Date of Session: 07/02/14 **Scoping Session Purpose:** Discuss upcoming waste cell sampling	

Name	Title	Affiliation	Phone #	E-mail Address	Project Role
Stephen Blaze	WAM	ERT	732-906-6921	Blaze.stephen@epa.gov	Technical Direction
Eugenia Naranjo	RPM	EPA R2	212-637-3467	Naranjo.eugenia@epa.gov	Project Oversight
Marc S. Greenberg	Deputy Branch Chief	ERT	732-452-6413	Greenberg.marc@epa.gov	Project Technical Direction
Deb Killeen	QA/QC Officer	SERAS	732-321-4245	Deborah.a.killeen@lmco.com	QA/Validation Oversight/QAPP Preparation
Christopher Gussman	Environmental Scientist (Phytoremediation)/TL	SERAS	732-321-4237	Christopher.d.gussman@lmco.com	Task Leader/Project Oversight & Coordination

Comments/Decisions: Two cores will be advanced into each waste cell. Up to four samples will be collected from each of the two cores at Givaudan and at Diamond Alkali. Lockheed has been in contact with a New Jersey licensed site remediation specialist (LSRP) who can be available for this project. The proposed repair methods for the Givaudan and Diamond Alkali waste cells need to be included in the QAPP.

Action Items: Need to include these items into QAPP and send to Eugenia.

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #10 (November 2013 & Summer 2015 Mobilizations)
Problem Definition

The problem to be addressed by the project:
A limited and focused study will be conducted by the ERT at the request of the EPA Region 2 Emergency and Remedial Response Division (ERRD) to evaluate potential sources of contamination found in the sediment deposit at river mile (RM) 10.9 of the Passaic River including both the former Givaudan facility and the former Diamond Alkali facility. This study will provide data that will be used by EPA Region 2 to inform future site management decisions.

The Lower Passaic River (LPR) is an operable unit of the Diamond Alkali Superfund Site. The LPR 17-mile Remedial Investigation/Feasibility Study (RI/FS) is being conducted by a group of approximately 70 potentially responsible parties (PRPs) called the Cooperating Parties Group (CPG) under an Administrative Order of Consent (AOC) that was signed in May 2007. The RI/FS is scheduled to be complete in 2015. The LPR is tidal and flows from the Dundee Dam at RM 17.4 through densely populated and industrialized areas into Newark Bay. Beginning in the early nineteenth century, the LPR watershed was a major center for industrialized operations including cotton mills, manufactured gas plants, paper manufacturing and chemical manufacturing facilities. These facilities discharged dioxins, petroleum hydrocarbons, PCBs, pesticides and metals to the LPR. Dioxins continue to be a risk driver at the site. CPG has agreed to perform the actions necessary to remove, treat and/or properly dispose of approximately 20,000 cubic yards (yd^3) of sediment from the designated RM 10.9 Removal Area and cap this area, to address elevated concentrations of polychlorinated dibenzodioxins/polychlorinated dibenzofurans (PCDDs/PCDFs), PCBs, metals and polyaromatic hydrocarbons (PAHs) detected in the sediment at RM 10.9.

The former Givaudan facility is situated on approximately 31 acres in a mixed industrial/residential area near RM 10.9 of the western river bank of the LPR in Clifton, NJ. The Passaic River is located approximately 0.3 miles to the southeast of the facility and is tidally influenced.

Givaudan manufactured flavors, fragrances and specialty chemicals and operated at this location from 1924 to 1998. Trichlorophenol was used in the manufacture of HCP. Dioxin is inherently a contaminant of the trichlorophenol feed stock and may be present in resultant production process wastes. HCX has also been associated with the production of HCP Givaudan ceased operation of the facility in 1998 and subsequently sold the facility property, except the lot on which the dioxin cell is located. Despite the change in site ownership, Givaudan retains responsibility for ongoing groundwater remedial action and monitoring at the former Givaudan site, although the dioxin cell must be accessed through a parking lot across private property.

From 1951 to 1969, the Diamond Alkali Company (subsequently known as the Diamond Shamrock Chemicals Company) owned and operated a pesticides manufacturing plant at 80 Lister Avenue in Newark. The property was used for manufacturing by numerous companies for more than 100 years. The mid-1940s marked the beginning of the manufacturing operations related to the current site conditions, including the production of DDT and phenoxy herbicides. Subsequent owners used the property until 1983, when sampling at the site and in the Passaic River revealed high levels of dioxin. Dioxin (also known as 2,3,7,8-tetrachlorodibenzo-p-dioxin or TCDD) is an extremely toxic chemical and an unwanted byproduct of the manufacture of certain chemicals which were produced at the site.

The environmental questions being asked:
Are compounds that may be potentially linked to the Givaudan facility or Diamond Alkali facility present or absent from the sediments at RM 10.9?
Are the ratios and/or chemical chromatographic signatures of contaminants found in the river sediments similar to those ratios found in samples collected from the Givaudan and/or Diamond Alkali waste cells?
How similar or dissimilar are the contaminant ratios and/or chemical chromatographic signatures between the Givaudan and the Diamond Alkali waste cells?

Observations from any site reconnaissance reports: NA
A synopsis of existing data or information from site reports: Technical papers regarding analytical methods for the compounds of interest will be used as references for method enhancement. Diagrams, figures, inter-office memos, etc. will aid in the development of the conceptual site model to determine potential contaminant transport pathways to the Passaic River.
The possible classes of contaminants and the affected matrices: PCDDs/PCDFs, pesticides, total PCBs, PCB congeners, HCP, HCX and TCDT in sediment and soil in waste cells
The rationale for inclusion of chemical and nonchemical analyses: PCDDs/PCDFs – Dioxins continue to be a risk driver for the site. These compounds are associated with Givaudan's and/or Diamond Alkali's former operations and elevated concentrations in this area were previously documented. Total PCB and PCB congeners – Elevated concentrations in this area were previously documented. HCP – This compound was previously produced at the Givaudan facility from trichlorophenol HCX – This compound has been associated with the production of HCP TCDT – The ratio of 2,4,6,8 – TCDT to 2,3,7,8-TCDD is expected to be useful for environmental forensics. Cesium-137 and Beryllium-7 – Used for dating the age of the sediments.
Information concerning various environmental indicators: The RM 10.9 Removal Action will include dredging of the sediment to a predetermined depth (uppermost two feet). An engineering cap will be constructed, monitored and maintained. A small portion along the shore at the northeastern most end of the Removal Area cannot be capped due to the grade of the existing slope; thus, this small portion will be dredged to remove contaminated sediment to native material. The Jersey City Municipal Authority has established a no-dredge zone in the vicinity of two potable water supply lines that transect the RM 10.9 Removal Area.
Project decision conditions ("If..., then..." statements): If PCDDs/PCDFs, PCB congeners, HCP, HCX and TCDT are detected in river sediments, then ERT will evaluate the potential linkage of these contaminants to known sources or potentially new sources in light of the historical data and conceptual site model of the contaminant transport pathways. Detection limits will be determined using an approved method for each analyte of concern. The Reporting Limits (RLs) will be based on the lowest standard on the initial calibration curve. If the ratios or multivariate analysis of contaminants of concern indicate a pattern and linkages to known sources, then EPA Region 2 will use this information to determine future actions.

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #11 (November 2013 & Summer 2015 Mobilizations)
Project Quality Objectives /Systematic Planning Process Statements

Who will use the data? ERT, EPA Region 2, ERRD and the Office of Regional Counsel (ORC)
What will the data be used for? Data will be used to evaluate potential sources of contamination at RM 10.9 and may increase EPA's understanding of the LPR.
What type of data is needed? (target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques) PCDD/PCDFs + non 2,3,7,8-TCDDs/TCDFs by EPA Method 1613B, off-site laboratory PCB Congeners and total PCBs by EPA Method 1668C, off-site laboratory HCX, HCP and TCDT by laboratory-developed methods, off-site laboratory Cesium-137 (Cs-137) and Beryllium-7 (Be-7) by gamma spectrometry, off-site laboratory, sediment samples only GPS data of each sample location, field data
How "good" do the data need to be in order to support the environmental decision? PCDD/PCDF + non 2,3,7,8-TCDDs/TCDFs, PCB congeners, total PCBs, HCX, HCP, TCDT, Cs-137 and Be-7 will be considered Definitive Data. GPS data will be considered supporting meta data and Screening Data (verified but not validated).
How much data are needed? (number of samples for each analytical group, matrix, and concentration) From the River: PCDD/PCDFs, PCB Congeners, HCX, HCP, TCDT – 19 sediment samples, Cs-137 and Be-7 – 50 sediment samples and GPS – 13 sediment locations. From the Dioxin-Contaminated Cells: PCDD/PCDFs, PCB Congeners, HCX, HCP, TCDT – Up to 12 soil samples, 4 from Givaudan and 8 from Diamond Alkali. If sufficient material is not obtained from the Diamond Alkali site from the four planned cores, then two additional cores may be advanced.

Where, when, and how should the data be collected/generated?
Sediment samples will be collected the week of November 18, 2013 using vibracore techniques. The river has been broken down into three areas of interest: the "no-dredge" zone within a portion of the Removal Area; the area below the designated Removal Area; and the confluence of the Passaic and Third Rivers and within the Third River. Sediment samples will be collected from the locations identified on Figure 1, Proposed Sampling Map. An additional sample will be collected near the area known as the Dundee Dam, upstream of the confluence of the Third and Passaic Rivers as a reference. Specific information on depths and analyses can be found on Worksheet #14.

In Summer 2015, approximately four samples will be collected from the dioxin-containment cell on the Givaudan property and approximately eight samples from the containment cell on the Diamond Alkali property. Two cores will be advanced on the Givaudan property and four to six cores on the Diamond Alkali property using direct push technology. At Diamond Alkali four cores will be collected initially. The material within the cores will be carefully examined. If the material in the core does not appear to be the contaminated waste soil (e.g. if the cores contain debris or other non-representative material), up to two additional cores may be collected.

The Givaudan Waste Cell (GWC) was designed specifically for TCDD-contaminated soil. The surface of the containment cell is covered with asphalt at ground level and surrounded by chain-link fence. The appearance is of a fenced parking lot or similar although the area is not currently in use. The cell was built on an area of the site not impacted by TCDD during the TCDD investigation. The cell was excavated to a depth of approximately 17 feet deep and the bottom and sides of the cell are lined with geotextile filter fiber. Soils with TCDD concentrations greater than 20 micrograms per kilogram (µg/kg) were placed vertically and horizontally in the central portion of the cell. The cell was capped with a geotextile filter fabric, 2-feet of clean soil with an embedded vinyl coated chain link fence (warning barrier) and 6 inches of crushed stone. An asphalt cover was then placed over the stone over the surface of the entire cell. Current and future land use is restricted on this cell. Access to this cell will be through a parking lot across private property.

Where, when, and how should the data be collected/generated?
The cell at the Diamond Alkali facility is located adjacent to the Passaic river. In August 1998, EPA and NJDEP approved the design plans, and construction of the cell began in early 2000. A warehouse and other structures that were present at the site were demolished. The contents of the drums and shipping containers were stabilized and immobilized and then disposed in the contaminated area of the site. Empty drum and containers were either recycled or crushed and disposed in the cell. The site is capped and kept secure and hazardous wastes at the site are contained and prevented from leaving the properties via engineering controls including the cap, slurry wall and flood wall. The cap includes several layers to minimize water movement such as geomembrane and clay. The surface of the cell is sloped to encourage runoff of precipitation off the cap and minimize percolation of water through the cap. The surface is covered in a layer of stone. Groundwater that does occur is pumped and treated on site and continuously monitored. In the area of interest, the fill including surface barrier is estimated to be about 17- 20' above the underlying clean soil.
At the former Diamond Alkali facility, the cores will be advanced in the area of the former process building (northwest portion of the waste cell) where it is anticipated that the highest TCDD concentrations will be found. Exact locations will logistically be dependent on the locations of the rods and the "deadman" wall constructed as part of the cell. The approximate area of interest is outlined in Figure 2. For the Givaudan Waste Cell (GWC), the goal will be to collect the highest contaminated TCDD soil which is located in the center of the cell. Care will be taken to minimize the cell structure and to repair any damage afterwards. The focus will therefore be on the center of the cell where soil with contamination (greater than 20 µg/kg TCDD) was contained.

Who will collect and generate the data?

A vibracore contractor will be procured to advance sediment core samples to approximate depths below the sediment surface depending on design targets (see Worksheets 14, 17 and 18) and collect GPS data on those cores. Sediment cores will be recovered and transferred to SERAS personnel for processing after they are collected, cut and capped. GPS data on locations where vibracoring is not an option (i.e., depositional sediment surface sampling in the Third River) will be recorded by SERAS field personnel. Sediment samples after processing will be submitted to Vista Analytical and Outreach laboratories for analysis.

Soil samples to be collected from the GWC and the Diamond Alkali property will be submitted to Vista Analytical for analysis.

For waste cell sampling at both locations, LM/SERAS will utilize a Geoprobe to perform drilling activities to collect cores from the two waste cells. The Geoprobe MC5 sampling system will be utilized to collect soil cores down to pre-determined depths. The MC5 sampling system houses a PVC liner (core) along with an inner-rod, drive head, drive point and cutting shoe. The MC5 is driven as a closed system down to 5 feet and as this is happening the drive point is moving upward within the liner, allowing the soil core to enter the liner. Once the 5-foot core has been collected it is retrieved and then the sample core is extracted. The process can be repeated until the desired sampling depth is reached. The core is then transferred to a table where it will be cut open, logged, homogenized and sampled. All efforts will be made to minimize damage to the geotextile/geomembrane liners during sampling of the respective waste cells. Once the bore hole has been abandoned it will then be grouted to prevent any vertical cross-contamination within the hole

How will the data be reported?

Validated data for the sediment samples will be reported in a Final Analytical Report (AR) that will be prepared in accordance with SERAS standard operating procedure (SOP) #4020, Analytical Report Preparation. A Trip Report (TR) will be prepared and delivered to the EPA/ERT WAM in accordance with SERAS SOP #4017, Preparation of Trip Reports after the last field mobilization. A draft summary report will be prepared that will include a weight of evidence discussion with accompanying tables and spreadsheets that summarize the data. This report will be prepared in accordance with SERAS SOP #4019, Preparation of Preliminary Reports. Data will be disseminated to EPA Region 2 by the WAM.

How will the data be archived?

Hard copies of all deliverables will be stored in SERAS Central Files and e-copies will be stored on SERAS Local Area Network (LAN). Data will be imported into a Scribe database and posted to the ERT IMS website. Data will be archived by SERAS in accordance with Administrative Procedure (AP) #34, Archiving Data Electronic Files. Analytical data from the outside laboratory will be archived by the SERAS QA/QC Group both in hard copy and electronically.

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #12-1 (November 2013 & Summer 2015 Mobilizations)
Measurement Performance Criteria Table

Matrix	Sediment or Soil
Analytical Group	PCDD/PCDF + non 2,3,7,8-TCDDs/TCDFs
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria		QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or Both (S&A)
SERAS SOP #2016	EPA Method 1613	Accuracy/Bias (Contamination)	<Reporting Limit (RL)		Method Blank (MB)	A
		Accuracy/Bias	2378-TCDD	6.7-15.8 ng/mL	Ongoing Precision & Accuracy (OPR)	A
			2378-TCDF	7.5-15.8 ng/mL		
			12378-PeCDD	35-71 ng/mL		
			12378-PeCDF	40-67 ng/mL		
			23478-PeCDF	34-80 ng/mL		
			123478-HxCDD	35-82 ng/mL		
			123678-HxCDD	38-67 ng/mL		
			123789-HxCDD	32-81 ng/mL		
			123478-HxCDF	36-67 ng/mL		
			123678-HxCDF	42-65 ng/mL		
			123789-HxCDF	39-65 ng/mL		
			234678-HxCDF	35-78 ng/mL		
			1234678-HpCDD	35-70 ng/mL		
			1234678-HpCDF	41-61 ng/mL		
			1234789-HpCDF	39-69 ng/mL		
			OCDD	78-144 ng/mL		
			OCDF	63-170 ng/mL		
			$^{13}C_{12}$-2378-TCDD	20-175 ng/mL		
			$^{13}C_{12}$-2378-TCDF	22-152 ng/mL		
			$^{13}C_{12}$-12378-PeCDD	21-227 ng/mL		
			$^{13}C_{12}$-12378-PeCDF	21-192 ng/mL		
			$^{13}C_{12}$-23478-PeCDF	13-328 ng/mL		
			$^{13}C_{12}$-123478-HxCDD	21-193 ng/mL		

QAPP Worksheet #12-1 (November 2013 & Summer 2015 Mobilizations)
Measurement Performance Criteria Table

Matrix	Sediment or Soil
Analytical Group	PCDD/PCDF + non 2,3,7,8-TCDDs/TCDFs
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria		QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or Both (S&A)
			$^{13}C_{12}$-123678- HxCDD	25-163 ng/mL		
			$^{13}C_{12}$-123789 HxCDD	21-193 ng/mL		
			$^{13}C_{12}$-123478-HxCDF	19-202 ng/mL		
			$^{13}C_{12}$-123678-HxCDF	21-159 ng/mL		
			$^{13}C_{12}$-123789-HxCDF	17-205 ng/mL		
			$^{13}C_{12}$-234678-HxCDF	22-176 ng/mL		
			$^{13}C_{12}$-1234678-HpCDD	26-166 ng/mL		
			$^{13}C_{12}$-1234678-HpCDF	21-158 ng/mL		
			$^{13}C_{12}$-1234789-HpCDF	20-186 ng/mL		
			$^{13}C_{12}$-OCDD	26-397 ng/mL		
			$^{13}C_{12}$-OCDF	26-397 ng/mL		
			$^{37}Cl_4$-2378-TCDD	3.1-19.1 ng/mL		
		Accuracy/Bias	$^{13}C_{12}$-2378-TCDD	25-164 ng/mL	Internal Standards (Samples)	A
			$^{13}C_{12}$-2378-TCDF	24-169 ng/mL		
			$^{13}C_{12}$-12378-PeCDD	25-181 ng/mL		
			$^{13}C_{12}$-12378-PeCDF	24-185 ng/mL		
			$^{13}C_{12}$-23478-PeCDF	21-178 ng/mL		
			$^{13}C_{12}$-123478-HxCDD	32-141 ng/mL		
			$^{13}C_{12}$-123678- HxCDD	28-130 ng/mL		
			$^{13}C_{12}$-123789 HxCDD	32-141 ng/mL		
			$^{13}C_{12}$-123478-HxCDF	26-152 ng/mL		
			$^{13}C_{12}$-123678-HxCDF	26-123 ng/mL		
			$^{13}C_{12}$-123789-HxCDF	29-147 ng/mL		
			$^{13}C_{12}$-234678-HxCDF	28-136 ng/mL		
			$^{13}C_{12}$-1234678-HpCDD	23-140 ng/mL		
			$^{13}C_{12}$-1234678-HpCDF	28-143 ng/mL		

QAPP Worksheet #12-1 (November 2013 & Summer 2015 Mobilizations)
Measurement Performance Criteria Table

Matrix	Sediment or Soil
Analytical Group	PCDD/PCDF + non 2,3,7,8-TCDDs/TCDFs
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria		QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A), or Both (S&A)
			$^{13}C_{12}$-1234789-HpCDF	26-138 ng/mL		
			$^{13}C_{12}$-OCDD	17-157 ng/mL		
			$^{13}C_{12}$-OCDF	17-157 ng/mL		
			$^{37}Cl_4$-2378-TCDD	35-197 ng/mL		
		Precision	Relative Percent Difference (RPD) ±35%		Field Duplicate	S & A
		Accuracy/Bias	%R = 50-150 (for native compounds only)		Matrix Spike (MS)	S & A
		Precision	RPD ±20%		MS/Matrix Spike Duplicate (MSD)	S & A
		Completeness	>90% sample collection, >90% completed analyses		Data Completeness Check	S & A

[1]Reference number from QAPP Worksheet #21 (see Section 3.1.2)
[2]Reference number from QAPP Worksheet #23 (see Section 3.2)

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #12-2 (November 2013 & Summer 2015 Mobilizations)
Measurement Performance Criteria Table

Matrix	Sediment or Soil
Analytical Group	PCB Congeners
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
SERAS SOP #2016	EPA Method 1668C	Accuracy/Bias (Contamination)	<RL	MB	A
		Accuracy/Bias	%Recovery (R) = 60-135	OPR*	A
		Accuracy/Bias	^{13}C-Mono, Di, TriCB + ^{13}C-23'4'5-TetraCB (%R = 5-145) Remaining Tetra, Penta, Hexa, Hepta , Octa, Nona and DecaCBs (%R = 10-145)	Internal Standards	A
		Accuracy/Bias	%R = 10-145	Cleanup Recovery Standards	A
		Accuracy/Bias	%R = 50-150%	MS*	S & A
		Precision	RPD ±20%	MS/MSD*	S & A
		Precision	RPD ±35%	Field Duplicate	S & A
		Completeness	>90% sample collection, >90% completed analyses	Data Completeness Check	S & A

[1]Reference number from QAPP Worksheet #21 (see Section 3.1.2)
[2]Reference number from QAPP Worksheet #23 (see Section 3.2)
*Spiked with PCB-5/PCB-8, PCB-18, PCB-20/21/33, PCB-28, PCB-31, PCB-43/49, PCB-44, PCB-52/69, PCB-56/60, PCB-61/70, PCB-74, PCB-76/66, PCB-87/117/125, PCB-90/101, PCB-95/98/102, PCB-97, PCB-99, PCB-105, PCB-118/106, PCB-110, PCB-128/162, PCB-132/161, PCB-138/163/164, PCB-139/149, PCB-146/165, PCB-151, PCB-153, PCB-156, PCB-158/160, PCB-170, PCB-174, PCB-177, PCB-180, PCB-182/187, PCB-183, PCB-194, PCB-195, PCB-196/203, PCB-201.

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #12-3 (November 2013 & Summer 2015 Mobilizations)
Measurement Performance Criteria Table

Matrix	Sediment or Soil
Analytical Group	Low
Concentration Level	HCX

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
SERAS SOP #2016	Vista SOP #41 Revision 2	Accuracy/Bias (Contamination)	<RL	MB	A
		Accuracy/Bias	%R = 50-150	OPR	A
		Accuracy/Bias	%R = 25-150 (Samples/Blanks) %R=30-140 (OPR)	^{13}C-123789-HxCDF (Internal Standard)	A
		Accuracy/Bias	50%≤Area≤200% of continuing calibration (CCAL) Area	^{13}C-123789HxCDD (Cleanup Recovery Standard)	A
		Accuracy/Bias	%R = 50-150	MS	S & A
		Precision	RPD ±25%	MS/MSD*	S & A
		Precision	RPD ±35%	Field Duplicate	S & A
		Completeness	>90% sample collection, >90% completed analyses	Data Completeness Check	S & A

[1]Reference number from QAPP Worksheet #21 (see Section 3.1.2)
[2]Reference number from QAPP Worksheet #23 (see Section 3.2)

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #12-4 (November 2013 & Summer 2015 Mobilizations)
Measurement Performance Criteria Table

Matrix	Sediment or Soil
Analytical Group	HCP
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
SERAS SOP #2016	Vista SOP #50 Revision 2	Accuracy/Bias (Contamination)	<RL	MB	A
		Accuracy/Bias	%R = 50-120%	OPR	A
		Accuracy/Bias	%R = 5-153 (Samples/Blank) %R=5-168 (OPR)	^{13}C-Hexachlorophene (Internal Standard)	A
		Accuracy/Bias	%R = 50-150	MS	S & A
		Precision	RPD ±50%	MS/MSD	S & A
		Precision	RPD ±35%	Field Duplicate	S & A
		Completeness	>90% sample collection, >90% completed analyses	Data Completeness Check	S & A

[1]Reference number from QAPP Worksheet #21 (see Section 3.1.2)
[2]Reference number from QAPP Worksheet #23 (see Section 3.2)

QAPP Worksheet #12-5 (November 2013 & Summer 2015 Mobilizations)
Measurement Performance Criteria Table

Matrix	Sediment or Soil
Analytical Group	TCDT
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Indicators (DQIs)	Measurement Performance Criteria	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
SERAS SOP #2016	Vista SOP #53, Rev. 0.0	Accuracy/Bias (Contamination)	<RL	MB	A
		Accuracy/Bias	%R = 67-158%	OPR	A
		Accuracy/Bias	%R = 25-164 (Samples/Blank) %R = 20-175 (OPR)	^{13}C-2,4,6,8-TCDT (Internal Standard)	A
		Accuracy/Bias	%R = 50-150	MS	S & A
		Precision	RPD ±20%	MS/MSD	S & A
		Precision	RPD ±35%	Field Duplicate	S & A
		Completeness	>90% sample collection, >90% completed analyses	Data Completeness Check	S & A

[1]Reference number from QAPP Worksheet #21 (see Section 3.1.2)
[2]Reference number from QAPP Worksheet #23 (see Section 3.2)

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #12-6 (November 2013 Mobilization)
Measurement Performance Criteria Table

Matrix	Sediment
Analytical Group	Radiochemistry for Be-7 and Cs-137
Concentration Level	Low

Sampling Procedure[1]	Analytical Method/SOP[2]	Data Quality Indicators (DQIs)	Measurement Performance Criteria[4]	QC Sample and/or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or Both (S&A)
SERAS SOP #2016	Outreach SOP #RAD_04-11	Precision	<20% RPD	Laboratory Duplicates	A
		Precision	RPD ±35%	Field Duplicates	S & A
		Accuracy	%R = 80-120% or acceptance range set by vendor	Laboratory Control Sample (LCS)	A
		Completeness	>90% sample collection, >90% completed analyses	Data Completeness Check	S & A

QAPP Worksheet #13
Existing Data Criteria and Limitations Table

Existing Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Historical River Mile 10.9 Analytical Data	EPA Region 2 Final Data Deliverable	Various Contract Laboratories, Dioxin/Furan Data for RM 10.9, August 2008 to May 2012	Will be used to determine areas of contaminant concern	Previous sampling designs are unknown. Sample location selection was limited to recent data only.
Historical River Mile 10.9 Analytical Data	EPA Region 2 Final Data Deliverable	Various Contract Laboratories, PCB Congener Data for RM 10.9, August 2011 to May 2012	Will be used to determine areas of contaminant concern	Previous sampling designs are unknown. Sample location selection was limited to recent data only.
Historical River Mile 10.9 Analytical Data	EPA Region 2 Final Data Deliverable	Various Contract Laboratories, Total PCB Data for RM 10.9, August 2008 to February 2012	Will be used to determine areas of contaminant concern	Previous sampling designs are unknown. Sample location selection was limited to recent data only.
Historical River Mile 10.9 Analytical Data	EPA Region 2 Final Data Deliverable	Various Contract Laboratories, WHO-PCB Data for RM 10.9, August 2008 to May 2012	Will be used to determine areas of contaminant concern	Previous sampling designs are unknown. Sample location selection was limited to recent data only.
Historical River Mile 11 to 11.5 Analytical Data	EPA Region 2 Final Data Deliverable	Various Contract Laboratories, Dioxin/Furan Data for RM 10.9, December 1991 to June 2012	Will be used to determine areas of contaminant concern	Previous sampling designs are unknown. Sample location selection was limited to recent data only.
Historical Third River Analytical Data	EPA Region 2 Final Data Deliverable	Various Contract Laboratories, Dioxin/Furan Data for RM 10.9, February 1990 to August 2008	Will be used to determine areas of contaminant concern	Previous sampling designs are unknown. Sample location selection was limited to recent data only.
Final Design Report for Removal Action	CPG, Newark, NJ River Mile 10.9 Removal Action Final Design Report, Lower Passaic River Study Area, May 6, 2013	CH2MHill, TCDD, total PCB, mercury data	Removal area summary of chemical parameters and identification of utilities within the no-dredge zone	No coordinates are given for the no-dredge zone

QAPP Worksheet #13
Existing Data Criteria and Limitations Table

Existing Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Diagram	Givaudan Plant Sewer System Diagram, 1970.	Givaudan Plant Sewer System Diagram, provided by Tierra Solutions, Inc., obtained from NJDEP Bureau of Nonpoint Pollution Control of DWQ in response to an OPRA request	Used to develop conceptual site model	.---
Diagram	Givaudan, October 12, 1983	Site Storm Drainage Sewer System Diagram	Used to develop conceptual site model	---
Diagram	Givaudan, October 12, 1983	Site Stormwater Drainage Diagram	Used to develop conceptual site model	---
Diagram	Givaudan, April 5, 1991	Contaminated TCDD Non-Process Areas	Used to develop conceptual site model	---
Closure Activities	Givaudan-Roure Lagoon Closure Plan, NJPDES Permit No. NJ088374, May 1, 1996	Crest Engineering Associates, Inc., Hightstown, NJ, On-site storm sewer system changes	Used to develop conceptual site model	---
Bypassed Waste	Affidavit of Seymour A. Letkin, January 6, 1994	State of Florida, County of Palm Beach	Used to develop conceptual site model	---
Map	Clifton Storm Sewers	Undated	Used to develop conceptual site model	---
Inter-Office Memo	Givaudan, Interoffice Memo, December 22, 1995	Stormwater Management Master Plan	Used to develop conceptual site model	---
Map	Givaudan, Delineated TCDD Remediated Areas and Sample Locations	Environmental Resources Management (ERM), Inc.	Used to develop conceptual site model	---

QAPP Worksheet #13
Existing Data Criteria and Limitations Table

Existing Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Map	ERM, Figure 1-3, Abandoned Waste Site Location Map, Givaudan Corporation	From Draft Endangerment Assessment Report for Ground Water; Givaudan Corporation, Delawanna Avenue Facility, Volume 1. ERM, October 28, 1988. Prepared for: Givaudan Corporation, Clifton, NJ. , Provided by Tierra Solutions, Inc., obtained from NJDEP Site Remediation in response to an OPRA request.	Used to develop conceptual site model	---
Memo	NJDEP, July 14, 1981	Site Inspection Report, Site Tour	Used to develop conceptual site model	---
Diagram	Killam Associates	Passaic Valley Sewerage Commission, Overflow Chamber, Yantacaw Street, Clifton	Used to develop conceptual site model	---
Letter	Givaudan, April 18, 1984	USEPA, Office of Solid Waste and Emergency Response (OSWER), Request for information on HCP process	Used to develop conceptual site model	---
Final Draft Report	USEPA, Waste Streams from Hexachlorophene Manufacturing Processes	Radian Corporation, Research Triangle Park (RTP), North Carolina (NC), production processes	Used to develop conceptual site model	---
Letter	Givaudan, April 30, 1984,	Radian Corp	Used to develop conceptual site model	---
Letter	Givaudan, June 19, 1984	Radian Corp on behalf of USEPA	Used to develop conceptual site model	---

QAPP Worksheet #13
Existing Data Criteria and Limitations Table

Existing Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Excerpt	Givaudan, A Current Overview of the Occurrence, Toxicity and Disposal of 2,3,7,8-TCDD, no date	TCDD pathways	Used to develop conceptual site model	---
Memo	Tierra Solutions, Recovery of G11 in Sewer Ditch and Pond, 1951	Givaudan, HCP product recovery	Used to develop conceptual site model	---
Letter to NJDEP	Givaudan –Roure Infiltration/Percolation Lagoon Industrial Contingency Requirements/Proposed Emergency Repair Plan	Discussion of overflow conditions	Used to develop conceptual site model	---
Report	Tierra Solutions, Inc., Hexachloroxanthene Method Development Report, May 2012	Environmental Data Services, Inc., validation of previous samples analyzed for HCX	Historical analytical data, analytical method and validation guidelines	---
Technical Paper	Archer & Crone, Hexachloroxanthene Analysis with TCDD, Organohalogen Compounds Vol. 45 (2000)	USEPA Region 7, HCX analysis	Historical background on HCX analysis	---
Technical Paper	Beliveau & al, Discovery of Dioxin Contamination in the Woonasquatucket River, Organohalogen Compounds, Volumes 60-65 (2003)	New England Regional Laboratory, HCX in the TCDD analysis	Historical background on HCX analysis	---
Technical Paper	Gothe & Wachtmeister, Synthesis of 124578-Hexachloroxanthene, Acta Chem. Scand. 26, No. 6 (1972)	Wallenberg Laboratory, University of Stockholm, HCX from HCP	Historical background on HCX from HCP	---

QAPP Worksheet #13
Existing Data Criteria and Limitations Table

Existing Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Technical Paper	J. Czerwinski, Pathways of Polychlorinated Dibenzothiophenes (PCDTs) in the Environment, Archives of Environmental Protection, Vol. 34, No. 3 (2008), pp. 169-181	Laboratory of Environmental Analyses, Faculty of Environmental Engineering, Lublin University of Technology, Lublin, Poland, PCDT sources and pathways in the environment	Historical background and analytical data	---
Technical Paper	Pruell et al, Accumulation of Polychlorinated Organic Contaminants from Sediment by Three Benthic Marine Species, Archives of Environmental Contamination and Toxicology, 24 (1993), pp.290-297	USEPA Environmental Research Laboratory, Narragansett, Rhode Island (RI), analytical method for 2,4,6,8-TCDT	Analytical data for TCDT	---
Technical Paper	S. Sinkkonen, PCDTs in the environment, Chemosphere, Vol 34, No 12,(1997), pp.2585-2594	Department of Chemistry, University of Jyvaskyla, Jyvaskyla, Finland, analytical methods for PCDTs	Historical background and methodology for PCDTs	---
Technical Paper	Huntley et al, Potential Sources of Polychlorinated Dibenzothiophenes in the Passaic River, New Jersey, Chemosphere, Vol 29, No. 2 (1994), pp.257-272	ChemRisk, MBT Environmental Laboratory and Alta Analytical Laboratory, PCDT sources and formation	Background information on PCDT generation	---
Technical Paper	Miltsov et al., Synthesis and Characterization of Polychlorinated Dibenzothiophenes, Organohalogen Compounds, Vol. 19 (1994), pp. 133-135	St Petersburg University, Department of Chemistry, synthesis of PCDTs	Background information on PCDT generation	---

QAPP Worksheet #13
Existing Data Criteria and Limitations Table

Existing Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Technical Paper	Tracy et al., Extraction and Analysis of Hexachloroxanthene using Modified US EPA Method 1613, Revision B Procedures, Organohalogen Compounds, Vol. 60. (2003), pp. 177-180	Battelle Memorial Institute, Columbus, Ohio (OH), HCX analytical methodology	Extraction and analysis of HCX	---
Figure & Analytical Report as an Appendix	Givaudan Boring Locations Dioxin Containment Cell, 2010 & PCDD/F Laboratory Report	Entrix, Dioxin/furan results for Givaudan waste cell	Background information	---
Technical Paper	Peterman et al, Enhanced GC/HRMS Chromatographic Analysis of PBDEs, PCDTs and Other Complex Mixtures with Narrow Bore Thin Film Columns, Organohalogen Compounds, Vol. 68 (2006), pp. 1170-1173	United States Geological Survey (USGS), Columbia Environmental Research Center, Columbia, Missouri (MO)	TCDT Analytical Information	---
Technical Paper	Barabas, Helfand, Dunkin, Turnham and Griffin, A tiered approach to fingerprinting dioxins: Distinguishing between an HCP manufacturing and a barrel reconditioning facility	Limno Tech, Exponent	Dioxin Fingerprinting	---
Technical Paper (1989)	Kjeller, Swanson and Rappe, Methyl-, Polymethyl- and Alkylpolychlorodibenzofurans identified in Pulp Mill Sludge and Sediment	Swiss Federation Research Station, Wasenswil, Switzerland	Background information	---

QAPP Worksheet #13
Existing Data Criteria and Limitations Table

Existing Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Technical Paper (May 17, 1996)	Zabel and Peterson, TCDD-Like Activity of 2,3,6,7-Tetrachloroxanthene in Rainbow Trout Early Life Stages and in a Rainbow Trout Gonadal Cell Line (RTG-2)	University of Wisconsin (Environmental Toxicology Center and School of Pharmacy) Madison, Wisconsin (WI)	Background information	---
Technical Paper (May 17, 1996)	Zabel, Pollenz and Peterson, Relative Potencies of Individual Polychlorinated Dibenzo-p-Dioxin, Dibenzofuran and Biphenyl Congeners and Congener Mixtures Based on Induction of Cytochrome P4501A mRNA in a Rainbow Trout Gonadal Cell Line (RTG-2)	University of Wisconsin (Environmental Toxicology Center and School of Pharmacy) Madison, WI	Background information	---
News Article (May 17, 1997)	Raloff, Those Old Dioxin Blues	Science News Online	Background information	---
Technical Paper (November 6, 1986)	Viswanathan, Weston, Kleopfer and Gierthy, The Measurement and Significance of 1,2,4,5,7,8-Hexachloroxanthene in the Environment	Jacobs Engineering Group Kansas City, Kansas U.S. EPA Laboratory Kansas City, Kansas Wadsworth Center for Laboratories and Research Albany, New York (NY)	Background information	---
Final Work Plan 4/16/2003	Battelle, Remedial Investigation and Feasibility Study: Centredale Manor Restoration Project Site	Battelle Duxbury, Massachusetts (MA) 023332	Background information	---
Interim Final 6/30/2005	Battelle, Remedial Investigation: Centredale Manor Restoration Project Site	Battelle Duxbury, Ma 023332	Background information	---

QAPP Worksheet #13
Existing Data Criteria and Limitations Table

Existing Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Technical Paper	Viswanathan and Kleopfer, The Presence of Hexachloroxanthene at Missouri Dioxin Sites	Chlorinated Dioxins and Dibenzofurans in Perspective:Rappe, Choudhary and Chelsea; Lewis Publishers pp. 201-210.	Background information	---
Technical Paper (On-Line) 9/10/2010	Chant, Fugate and Garvey The Shaping of an Estuarine Superfund Site: Roles of Evolving Dynamics and Geomorphology	Institute of Marine and Coastal Science, Rutgers University, New Brunswick, NJ; Florida Gulf Coast University, Fort Myers, FL; Malcolm Pirnie, White Plains, NY	Background information	---
Registry Report June 1986	Marlow and Fingerhut Dioxin Registry Report: Diamond Shamrock Corporation; Diamond Alkali Company	Industrial Hygiene Section, Industrywide Studies Branch, Division of Surveillance, Hazard Evaluations and Field Studies National Institute for Occupational Safety and Health (NIOSH) Centers for Disease Control (CDC), Cincinnati, OH	Background information	---
Site Visit Report March 1990	Piacitelli, Marlow and Fingerhut, NIOSH Dioxin Registry Site Visit Report of Givaudan Corporation Clifton, NJ	Industrial Hygiene Section, Industrywide Studies Branch, Division of Surveillance, Hazard Evaluations and Field Studies NIOSH CDC, Cincinnati, OH	Background information	---

QAPP Worksheet #13
Existing Data Criteria and Limitations Table

Existing Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Technical Paper November 1980	Esposito, Tiernan and Dryden Dioxins	Industrial Hygiene Section, Industrywide Studies Branch, Division of Surveillance, Hazard Evaluations and Field Studies NIOSH CDC, Cincinnati, OH	Background information	---
Hydrodynamic Modeling Report January 2008	HydroQual Inc. Lower Passaic River Restoration Project and Newark Bay Study	HydroQual Inc. Mahwah, NJ	Background information	---
Informative Report March 1984	Kulkarni and Kowalski Waste Streams From Hexachlorophene Manufacturing Process	Radian Corporation RTP, NC	Background information	---
Inter-Office Correspondence 4/11/1957	J. Burton Re: Purification of 2,4,5-Trichlorophenol for Hexachlorophene	Diamond Alkali Company Newark, NJ	Background information	---
Sampling Study (Briefing Document) 10/3/1983	NUS Corporation Givaudan Chemical Company Clifton, NJ	NUS Corporation	Background information	---
Navigation Study 12/29/2008	US Army Corps of Engineers Lower Passaic River Commercial Navigation Analysis	US Army Corps of Engineers New York District	Background information	---
Administrative Consent Order 3/05/1987	State of New Jersey Department of Environmental Protection In the Matter of Givaudan Corporation	State of New Jersey Department of Environmental Protection Trenton, NJ	Background information	---

QAPP Worksheet #13
Existing Data Criteria and Limitations Table

Existing Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Remedial Action Report September 2000	Environmental Resources Management, Remedial Action Report for 2,3,7,8-TCDD Excavation and Disposal Givaudan Roure Facility Clifton, NJ	Environmental Resources Management Exton, PA	Background information	---
Response Document July 9, 2004	Environmental Resources Management, Givaudan Fragrance Corporation Request for Information Response Document Vol. 2 Clifton, NJ	Environmental Resources Management Exton, PA	Background information	---
Sampling and Analysis Plan August 28, 1996	Environmental Resources Management, Givaudan Roure Corporation: Post Excavation Sampling of 2,3,7,8-TCDD Impacted Soil, Delawanna Avenue Facility Clifton, NJ	Environmental Resources Management Exton, PA	Background information	---
Directive (Letter) 3/12/2002	Department of Environmental Protection State of NJ Restriction of Site Use 125 Delawanna Ave. Clifton, NJ	State of NJ, Department of Environmental Protection; Bureau of Case Management	Background information	---
Givaudan Site Report January 1991	Environmental Resources Management, NJDEP Approved TCDD and Limited Investigation Reports	Environmental Resources Management Exton, PA	Background information	---
Hexachlorophene Shipment Letter 2/8/1983	Charles A. Lord, Givaudan Corporation	Givaudan Corporation 125 Delawanna Ave. Clifton, NJ	Background information	---
Manifest Correction Letter 2/8/1983	Charles A. Lord, Givaudan Corporation	Givaudan Corporation 125 Delawanna Ave. Clifton, NJ	Background information	---

QAPP Worksheet #13
Existing Data Criteria and Limitations Table

Existing Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Org., Data Types, Data Generation/ Collection Dates)	How Data Will Be Used	Limitations on Data Use
Final Report October 1999	Environmental Resources Management, Remedial Action Report for On-Site Containment of 2,3,7,8-TCDD-Impacted Soils, Delawanna Avenue Facility	Environmental Resources Management Exton, PA	Background information	---
Environmental Protection Agency (EPA) Report March 2005	EPA/ORD National Center for Environmental Assessment; The Inventory of Sources and Environmental Releases of Dioxin-Like Compounds in the U.S.: The Year 2000 Update	USEPA Washington, DC	Background information	---
Letter Re: Hexachlorophene Process July 1, 1983	M. Manowitz Givaudan Corporation	Givaudan Corporation 125 Delawanna Ave. Clifton, NJ	Background information	---
Letter Re: Notice/Order of De Bene Esse Depositions	Kelly-Anne Norgaard Gordon & Gordon Law Offices	Gordon & Gordon Springfield, NJ	Background information	---
Letter Re: Addendum to the Site Management Plan for Remedial Construction Activities—Diamond Alkali Superfund Site	Alex Pittignano U.S. Environmental Protection Agency (USEPA), Region II	USEPA, Emergency and Remedial Response Division Region II New York, NY	Background information	---
Remedial Design Drawings	Diamond Alkali Superfund Site, Newark, NJ; Attachment A, Final Modified (100%) Remedial Design Drawings; Prepared for Occidental Chemical Corporation, March 1996 (Revised July 1999)	Eckenfelder, Part of Brown and Caldwell, March 1996 (Revised July 1999), Job No. 9832	To determine the approximate area of interest for sample collection	——

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #14 (November 2013 & Summer 2015 Mobilizations)
Summary of Project Tasks

Sampling Tasks:
Sediment core samples will generally be obtained from surface to depths of 4 to 8 feet below the sediment surface using vibracore techniques (may be more than one core at some locations). Sediment core samples will be collected in four-inch diameter chemically clean rigid sleeves. During core recovery, the subcontractor must minimize sediment loss from the bottom of the core. When the cores are recovered, they will be capped on both ends and kept vertical to minimize disturbance of surficial layers until overlying water can be siphoned off. Locations will be recorded using GPS by the vibracoring subcontractor. The top of the core above the sediment surface will be removed and capped so that the core can be efficiently transported with minimal disturbance. The subcontractor along with SERAS personnel will inspect each core to ensure an intact and representative sample. Intact cores will then be transferred to LM personnel for processing. Samples will be collected in accordance with SERAS SOP #2016, *Sediment Sampling*.

The investigation area has been broken down into three areas of interest: the "no-dredge" zone within a portion of the Removal Area; the area below the designated Removal Area; and the confluence of the Passaic and Third Rivers and within the Third River.
"No-Dredge" Zone - Four cores will be advanced in the "no-dredge" zone to approximately 5 feet. Two samples will be collected from the 0-0.5' and 1-3' intervals and two samples from the 0-0.5' and 3-5' intervals for a total of 8 samples for PCDDs/PCDFs, 209 PCB congeners, total PCBs, HCX, HCP and TCDT. One additional core will be advanced at one of these locations to 5 feet and sampled at each 0.5' interval for Cs-137 and Be-7 for a total of 10 samples.
River Confluence - Two cores will be advanced at the confluence of the rivers to the bottom of the sediment bed. Samples will be collected from the 0-0.5' interval and one foot from the bottom of the sediment. Three additional sediment samples within the Third River on the other side of the Route 21 bridge will be collected at surface only (0-0.5') for a total of 7 samples for PCDDs/PCDFs, 209 PCB congeners, total PCBs, HCX, HCP and TCDT. One additional core will be advanced at one of the two locations at the confluence of the rivers and sampled at each 0.5' interval for Cs-137 and Be-7 for a total of 8-16 samples (depending on the depth).
Downstream of the Removal Area – Three cores will be advanced in this zone to approximately 8 feet. Sediment samples will be collected from the 6-8' interval for PCDDs/PCDFs, 209 PCB congeners, total PCBs, HCX, HCP and TCDT for a total of 3 samples. One additional core will be advanced in this area up to 8 feet with samples collected every 0.5 foot intervals for Cs-137 and Be-7 for a total of 16 samples.
Upstream Reference Location – One sediment sample will be collected from a location above Dundee Dam. It is anticipated that samples will be collected from the 0-0.5' and 1-2' intervals. One additional core will be advanced in this area up to 8 feet with samples collected every 0.5 foot intervals for Cs-137 and Be-7 for a total of 16 samples.

NOTE: Sampling depths are based upon previous information and may not be attainable at some locations.

All non-dedicated sampling equipment will be decontaminated between each sample location as follows:
1. Physical removal of sediment/debris using potable water and a scrub brush or high pressure washer.
2. Non-phosphate detergent wash (liquinox)
3. Water rinse
4. Air dry

Sampling Tasks (cont'd):
The dioxin-contaminated cells located at the former Givaudan property in Clifton, NJ and the Diamond Alkali Site Waste Cell (DASWC) located in Newark, NJ will be sampled in 2015 by Lockheed Martin/SERAS or a contractor under direction of EPA/ERT. Two cores will be collected in the Givaudan Cell and four to six cores from the Diamond Alkali Cell, resulting in approximately 12 samples combined total from the two waste cells. Split samples have been requested by Givaudan from their cell, and additional samples may be obtained from the collection for archiving. Sampling will occur carefully and every effort will be made to minimize disturbance of the waste cells, leaving them in good condition.

Analysis Tasks:
Dioxins/Furans + non-2,3,7,8-TCDDs/TCDFs by EPA Method 1613B, Sediment and Soil
PCB Congeners and total PCBs by EPA Method 1668C, Sediment and Soil
HCX – Vista SOP #41, Revision 2 (Gas Chromatography with high-resolution mass spectrometry [GC/HRMS]), Sediment and Soil
HCP – Vista SOP #50, Revision 2 (Liquid Chromatography with quadrapole mass spectrometry [LC/MS/MS]), Sediment and Soil
TCDT – Vista SOP #53, Revision 0 (Gas Chromatogrpahy with high-resolution mass spectrometry [GC/HRMS]), Sediment and Soil
Cs-137 and Be-7 – Outreach SOP #RAD_04-11 (Gamma Spectroscopy), Sediment Only

Quality Control Tasks: Refer to Worksheet #20 for field QC Samples and Worksheets #12 and #28 for analytical QC Samples based on subcontract laboratory SOPs.

Existing Data: Historical dioxin and PCB data will be mapped to determine the core locations and sample depths. Refer to Figure 1.

Data Management Tasks: Field data will be recorded in field notebooks. Laboratory data will be recorded in laboratory notebooks. SCRIBE will be used for data management. A Trip Report and a Technical Memorandum (Summary Report) will be posted to the ERT/Information Management System (IMS) website for this WA. Posting of the reports will be considered as completion of the deliverable. Hard copies of the deliverables will be archived in the SERAS Central Files. Electronic formats for the deliverables will be saved on the SERAS archive drive and archived in accordance with AP #34, *Archiving Electronic Files*.

Documentation and Records: Observations noted during field efforts will be documented in accordance with SERAS SOP #4001, *Logbook Documentation* and SERAS SOP #2002, *Sample Documentation*. Documents and records that will be generated during this project include: Work Plan (WP), QAPP, Health and safety plan (HASP), Field Documentation, Laboratory Logbooks, Sample Labels, Chain of Custody Records, Custody Seals, Analytical Report, Data Review Records, Data Reduction Records and Field Change Forms, if necessary. The trip report will include site background, observations and activities, and conclusions, results and/or recommendations. The trip report will be prepared in accordance with SERAS SOP #4017, *Preparation of Trip Reports*. The technical memorandum (summary report) will include brief text and risk summary tables.

Assessment/Audit Tasks: A performance audit of field operations is not anticipated for this project. The tasks associated with the QAPP are assessed using peer and management system reviews. Peer review enables the task leader to identify and correct reporting errors before reports are submitted. Management system reviews establish compliance with prevailing management structure, policies and procedures, and ensures that the required data are obtained.

Data Review Tasks: Analytical data for dioxins/furans, PCB congeners and total PCBs, HCX, HCP and TCDT will be validated in accordance with the SOPs listed in Worksheet #36. A full data package similar to a CLP deliverable will be requested. All SERAS project deliverables will receive an internal peer review prior to release as per the guidelines established in SERAS Administrative Procedure (AP) #22, *Peer Review of SERAS Deliverables*.

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #15-1 (November 2013 & Summer 2015 Mobilizations)
Reference Limits and Evaluation Table

Matrix: Sediment or Soil

Analytical Group: Dioxins/Furans + non-2,3,7,8-TCDDs/TCDFs

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (ng/kg)	Project Quantitation Limit (ng/kg)	Analytical Method EPA Method 1613B		Achievable Laboratory Limits	
				MDLs	Method QLs[1] (ng/kg)	MDLs (ng/kg)[2]	QLs[3] (ng/kg)
2378 - TCDD	1746-01-6	NS	0.50	NA	1.0	0.0510	0.50
12378 - PeCDD	40321-76-4	NS	2.5	NA	5.0	0.155	2.5
123678-HxCDD	57653-85-7	NS	2.5	NA	5.0	0.211	2.5
123478-HxCDD	39227-28-6	NS	2.5	NA	5.0	0.269	2.5
123789-HxCDD	19408-74-3	NS	2.5	NA	5.0	0.215	2.5
1234678 - HpCDD	35822-46-9	NS	2.5	NA	5.0	0.284	2.5
OCDD	3268-87-9	NS	5.0	NA	10.0	0.446	5.0
2378-TCDF	51207-31-9	NS	0.50	NA	1.0	0.0830	0.50
12378-PeCDF	57117-41-6	NS	2.5	NA	5.0	0.203	2.5
23478-PeCDF	57117-31-4	NS	2.5	NA	5.0	0.0905	2.5
123678-HxCDF	57117-44-9	NS	2.5	NA	5.0	0.0983	2.5
123789-HxCDF	72918-21-9	NS	2.5	NA	5.0	0.122	2.5
123478-HxCDF	70648-26-9	NS	2.5	NA	5.0	0.219	2.5
234678-HxCDF	60851-34-5	NS	2.5	NA	5.0	0.139	2.5
1234678-HpCDF	67562-39-4	NS	2.5	NA	5.0	0.164	2.5
1234789-HpCDF	55673-89-7	NS	2.5	NA	5.0	0.184	2.5
OCDF	39001-02-0	NS	5.0	NA	10.0	0.240	5.0
Total TCDD	NA	NS	NA	NA	NA	NA	NA
Total PeCDD	NA	NS	NA	NA	NA	NA	NA
Total HeCDD	NA	NS	NA	NA	NA	NA	NA
Total HpCDD	NA	NS	NA	NA	NA	NA	NA
Total TCDF	NA	NS	NA	NA	NA	NA	NA
Total PeCDF	NA	NS	NA	NA	NA	NA	NA
Total HxCDF	NA	NS	NA	NA	NA	NA	NA

QAPP Worksheet #15-1 (November 2013 & Summer 2015 Mobilizations)
Reference Limits and Evaluation Table

Matrix: Sediment or Soil

Analytical Group: Dioxins/Furans + non-2,3,7,8-TCDDs/TCDFs

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (ng/kg)	Project Quantitation Limit (ng/kg)	Analytical Method EPA Method 1613B		Achievable Laboratory Limits	
				MDLs	Method QLs[1] (ng/kg)	MDLs (ng/kg)[2]	QLs[3] (ng/kg)
Total HpCDF	NA	NS	NA	NA	NA	NA	NA
1,3,6,8-TCDD	33423-92-6	NS	NA	NA	NA	NA	NA
1,3,7,9-TCDD	62470-33-5	NS	NA	NA	NA	NA	NA
1,3,6,9-TCDD	40581-91-7	NS	NA	NA	NA	NA	NA
1,4,6,9-TCDD	40581-03-9	NS	NA	NA	NA	NA	NA
1,2,4,7-TCDD/ 1,2,4,6-TCDD/ 1,2,4,8-TCDD/ 1,2,4,9-TCDD	NA	NS	NA	NA	NA	NA	NA
1,3,7,8-TCDD	50585-46-1	NS	NA	NA	NA	NA	NA
1,2,6,8-TCDD	67323-56-2	NS	NA	NA	NA	NA	NA
1,4,7,8-TCDD	40581-94-0	NS	NA	NA	NA	NA	NA
1,2,7,9-TCDD	71669-23-3	NS	NA	NA	NA	NA	NA
1,2,3,4-TCDD/ 1,2,6,9-TCDD	30746-58-8 NA	NS	NA	NA	NA	NA	NA
1,2,3,6-TCDD	71669-25-5	NS	NA	NA	NA	NA	NA
1,2,3,7-TCDD/ 1,2,3,8-TCDD	NA NA	NS	NA	NA	NA	NA	NA
1,2,3,9-TCDD	71669-26-6	NS	NA	NA	NA	NA	NA
1,2,7,8-TCDD	34816-53-0	NS	NA	NA	NA	NA	NA
1,2,6,7-TCDD	40581-90-6	NS	NA	NA	NA	NA	NA
1,2,8,9-TCDD	62470-54-6	NS	NA	NA	NA	NA	NA
1,2,4,6,8-PeCDD/ 1,2,4,7,9-PeCDD	NA NA	NS	NA	NA	NA	NA	NA
1,2,4,6,9-PeCDD	NA	NS	NA	NA	NA	NA	NA
1,2,3,6,8-PeCDD	NA	NS	NA	NA	NA	NA	NA
1,2,4,7,8-PeCDD	NA	NS	NA	NA	NA	NA	NA

QAPP Worksheet #15-1 (November 2013 & Summer 2015 Mobilizations)
Reference Limits and Evaluation Table

Matrix: Sediment or Soil

Analytical Group: Dioxins/Furans + non-2,3,7,8-TCDDs/TCDFs

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (ng/kg)	Project Quantitation Limit (ng/kg)	Analytical Method EPA Method 1613B		Achievable Laboratory Limits	
				MDLs	Method QLs[1] (ng/kg)	MDLs (ng/kg)[2]	QLs[3] (ng/kg)
1,2,3,7,9-PeCDD	NA	NS	NA	NA	NA	NA	NA
1,2,4,6,7-PeCDD/ 1,2,3,6,9-PeCDD/ 1,2,4,8,9-PeCDD	NA NA NA	NS	NA	NA	NA	NA	NA
1,2,3,4,7-PeCDD/ 1,2,3,4,6-PeCDD	NA NA	NS	NA	NA	NA	NA	NA
1,2,3,6,7-PeCDD	NA	NS	NA	NA	NA	NA	NA
1,2,3,8,9-PeCDD	NA	NS	NA	NA	NA	NA	NA
1,2,4,6,7,9-HxCDD/ 1,2,4,6,8,9-HxCDD	NA NA	NS	NA	NA	NA	NA	NA
1,2,3,4,6,8-HxCDD	NA	NS	NA	NA	NA	NA	NA
1,2,3,6,7,9-HxCDD/ 1,2,3,6,8,9-HxCDD	NA NA	NS	NA	NA	NA	NA	NA
1,2,3,4,6,9-HxCDD	NA	NS	NA	NA	NA	NA	NA
1,2,3,4,6,7-HxCDD	NA	NS	NA	NA	NA	NA	NA
1,2,3,4,6,7,9-HpCDD	NA	NS	NA	NA	NA	NA	NA
1,3,6,8-TCDF	71998-72-6	NS	NA	NA	NA	NA	NA
1,4,6,8-TCDF	NA	NS	NA	NA	NA	NA	NA
2,4,6,8-TCDF	NA	NS	NA	NA	NA	NA	NA
1,3,4,6-TCDF/ 1,2,4,6-TCDF/ 1,3,4,7-TCDF/ 1,3,7,8-TCDF/ 1,2,4,7-TCDF	NA NA NA NA NA	NS	NA	NA	NA	NA	NA
1,3,4,8-TCDF	NA	NS	NA	NA	NA	NA	NA

QAPP Worksheet #15-1 (November 2013 & Summer 2015 Mobilizations)
Reference Limits and Evaluation Table

Matrix: Sediment or Soil

Analytical Group: Dioxins/Furans + non-2,3,7,8-TCDDs/TCDFs

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (ng/kg)	Project Quantitation Limit (ng/kg)	Analytical Method EPA Method 1613B		Achievable Laboratory Limits	
				MDLs	Method QLs[1] (ng/kg)	MDLs (ng/kg)[2]	QLs[3] (ng/kg)
1,2,4,8-TCDF 1,3,6,7-TCDF 1,3,7,9-TCDF	NA NA NA	NS	NA	NA	NA	NA	NA
1,2,6,8-TCDF	NA	NS	NA	NA	NA	NA	NA
1,4,6,7-TCDF	NA	NS	NA	NA	NA	NA	NA
1,4,7,8-TCDF	NA	NS	NA	NA	NA	NA	NA
1,3,6,9-TCDF 1,2,3,7-TCDF	NA NA	NS	NA	NA	NA	NA	NA
2,4,6,7-TCDF	NA	NS	NA	NA	NA	NA	NA
2,3,6,8-TCDF	NA	NS	NA	NA	NA	NA	NA
1,2,3,4-TCDF 1,2,3,8-TCDF 1,6,7,8-TCDF 1,4,6,9-TCDF 1,2,3,6-TCDF	NA NA NA NA NA	NS	NA	NA	NA	NA	NA
1,2,7,8-TCDF	58802-20-3	NS	NA	NA	NA	NA	NA
1,3,4,9-TCDF	NA	NS	NA	NA	NA	NA	NA
1,2,6,7-TCDF	NA	NS	NA	NA	NA	NA	NA
2,3,4,6-TCDF 1,2,4,9-TCDF	NA NA	NS	NA	NA	NA	NA	NA
1,2,7,9-TCDF 2,3,4,7-TCDF	NA NA	NS	NA	NA	NA	NA	NA
2,3,4,8-TCDF	NA	NS	NA	NA	NA	NA	NA
2,3,6,7-TCDF 3,4,6,7-TCDF	NA NA	NS	NA	NA	NA	NA	NA
1,2,6,9-TCDF	NA	NS	NA	NA	NA	NA	NA
1,2,3,9-TCDF	NA	NS	NA	NA	NA	NA	NA

QAPP Worksheet #15-1 (November 2013 & Summer 2015 Mobilizations)
Reference Limits and Evaluation Table

Matrix: Sediment or Soil

Analytical Group: Dioxins/Furans + non-2,3,7,8-TCDDs/TCDFs

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (ng/kg)	Project Quantitation Limit (ng/kg)	Analytical Method EPA Method 1613B		Achievable Laboratory Limits	
				MDLs	Method QLs[1] (ng/kg)	MDLs (ng/kg)[2]	QLs[3] (ng/kg)
1,2,8,9-TCDF	NA	NS	NA	NA	NA	NA	NA
1,3,4,6,8-PeCDF 1,2,4,6,8-PeCDF	NA NA	NS	NA	NA	NA	NA	NA
1,3,6,7,8-PeCDF 1,2,4,6,7-PeCDF 1,3,4,6,7-PeCDF	NA NA NA	NS	NA	NA	NA	NA	NA
1,2,3,6,8-PeCDF 1,3,4,7,8-PeCDF 1,2,4,7,8-PeCDF	NA NA NA	NS	NA	NA	NA	NA	NA
1,3,4,7,9-PeCDF	NA	NS	NA	NA	NA	NA	NA
1,3,4,6,9-PeCDF 1,2,4,7,9-ReCDF 1,2,3,4,6-PeCDF	NA NA NA	NS	NA	NA	NA	NA	NA
2,3,4,6,8-PeCDF 1,2,4,6,9-PeCDF 1,2,3,4,7-PeCDF	NA NA NA	NS	NA	NA	NA	NA	NA
1,2,3,4,8-PeCDF	NA	NS	NA	NA	NA	NA	NA
1,2,3,6,7-PeCDF 1,2,6,7,8-PeCDF	NA NA	NS	NA	NA	NA	NA	NA
1,2,3,7,9-PeCDF	NA	NS	NA	NA	NA	NA	NA
1,2,6,7,9-PeCDF	NA	NS	NA	NA	NA	NA	NA
2,3,4,6,7-PeCDF	NA	NS	NA	NA	NA	NA	NA
1,2,3,6,9-PeCDF 2,3,4,7,8-PeCDF 1,2,4,8,9-PeCDF	NA NA NA	NS	NA	NA	NA	NA	NA
1,2,3,4,9-PeCDF	NA	NS	NA	NA	NA	NA	NA
1,2,3,8,9-PeCDF	NA	NS	NA	NA	NA	NA	NA

QAPP Worksheet #15-1 (November 2013 & Summer 2015 Mobilizations)
Reference Limits and Evaluation Table

Matrix: Sediment or Soil

Analytical Group: Dioxins/Furans + non-2,3,7,8-TCDDs/TCDFs

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (ng/kg)	Project Quantitation Limit (ng/kg)	Analytical Method EPA Method 1613B		Achievable Laboratory Limits	
				MDLs	Method QLs[1] (ng/kg)	MDLs (ng/kg)[2]	QLs[3] (ng/kg)
1,2,3,4,6,8-HxCDF	NA	NS	NA	NA	NA	NA	NA
1,2,4,6,7,8-HxCDF 1,3,4,6,7,8-HxCDF	NA NA	NS	NA	NA	NA	NA	NA
1,3,4,6,7,9-HxCDF	NA	NS	NA	NA	NA	NA	NA
1,2,4,6,7,9-HxCDF	NA	NS	NA	NA	NA	NA	NA
1,2,4,6,8,9-HxCDF	NA	NS	NA	NA	NA	NA	NA
1,2,3,4,6,7-HxCDF	NA	NS	NA	NA	NA	NA	NA
1,2,3,4,7,9-HxCDF	NA	NS	NA	NA	NA	NA	NA
1,2,3,6,7,9-HxCDF	NA	NS	NA	NA	NA	NA	NA
1,2,3,4,6,9-HxCDF	NA	NS	NA	NA	NA	NA	NA
2,3,4,6,7,8-HxCDF 1,2,3,6,8,9-HxCDF	NA NA	NS	NA	NA	NA	NA	NA
1,2,3,7,8,9-HxCDF 1,2,3,4,8,9-HxCDF	NA NA	NS	NA	NA	NA	NA	NA
1,2,3,4,6,7,9-HpCDF	NA	NS	NA	NA	NA	NA	NA
1,2,3,4,6,8,9-HpCDF	NA	NS	NA	NA	NA	NA	NA

[1]Based on 10 grams (g) of sample and final volume of 20 microliters (µL)
[2]Based on LOD/LOQ Study from Vista Analytical dated 8/08/2013
[3]Final QL will be adjusted based on the total solids content for each sample.
NS = not specified, NA = not applicable
ng/kg = nanograms per kilogram

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #15-2 (November 2013 & Summer 2015 Mobilizations)
Reference Limits and Evaluation Table

Matrix: Sediment or Soil

Analytical Group: PCB Congeners

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (ng/kg)*	Project Quantitation Limit (ng/kg)	Analytical Method EPA Method 1668C		Achievable Laboratory Limits	
				MDLs* (ng/kg)	Method QLs* (ng/kg)	MDLs (ng/kg)[1]	QLs[2] (ng/kg)
2-MoCB (1)	2051-60-7	NS	2.5	Refer to Table 2	Refer to Table 2	0.644	2.5
3-MoCB (2)	2051-61-8	NS	2.5	Refer to Table 2	Refer to Table 2	0.821	2.5
4-MoCB (3)	2051-62-9	NS	2.5	Refer to Table 2	Refer to Table 2	1.12	2.5
2,2'-DiCB (4)	13029-08-8	NS	10.0	Refer to Table 2	Refer to Table 2	2.61[3]	10.0
2,3-DiCB (5)	16605-91-7	NS	10.0	Refer to Table 2	Refer to Table 2	2.64[4]	10.0
2,3'-DiCB (6)	25569-80-6	NS	5.0	Refer to Table 2	Refer to Table 2	2.16	5.0
2,4-DiCB (7)	33284-50-3	NS	10.0	Refer to Table 2	Refer to Table 2	2.11[5]	10.0
2,4'-DiCB (8)	34883-43-7	NS	10.0	Refer to Table 2	Refer to Table 2	2.64[4]	10.0
2,5-DiCB (9)	34883-39-1	NS	10.0	Refer to Table 2	Refer to Table 2	2.11[5]	10.0
2,6-DiCB (10)	33146-45-1	NS	10.0	Refer to Table 2	Refer to Table 2	2.61[3]	10.0
3,3'-DiCB (11)	2050-67-1	NS	5.0	Refer to Table 2	Refer to Table 2	2.82	5.0
3,4-DiCB (12)	2974-92-7	NS	10.0	Refer to Table 2	Refer to Table 2	4.92[6]	10.0
3,4'-DiCB (13)	2974-90-5	NS	10.0	Refer to Table 2	Refer to Table 2	4.92[6]	10.0
3,5-DiCB (14)	34883-41-5	NS	5.0	Refer to Table 2	Refer to Table 2	1.30	5.0
4,4'-DiCB (15)	2050-68-2	NS	5.0	Refer to Table 2	Refer to Table 2	2.87	5.0
2,2,3'-TrCB (16)	38444-78-9	NS	5.0	Refer to Table 2	Refer to Table 2	1.30[7]	5.0
2,2',4-TrCB (17)	37680-66-3	NS	2.5	Refer to Table 2	Refer to Table 2	0.990	2.5
2,2',5-TrCB (18)	37680-65-2	NS	2.5	Refer to Table 2	Refer to Table 2	1.13	2.5
2,2',6-TrCB (19)	38444-73-4	NS	2.5	Refer to Table 2	Refer to Table 2	1.03	2.5
2,3,3'-TrCB (20)	38444-84-7	NS	7.5	Refer to Table 2	Refer to Table 2	2.38[8]	7.5
2,3,4-TrCB (21)	55702-46-0	NS	7.5	Refer to Table 2	Refer to Table 2	2.38[8]	7.5
2,3,4'-TrCB (22)	38444-85-8	NS	2.5	Refer to Table 2	Refer to Table 2	0.933	2.5
2,3,5-TrCB (23)	55720-44-0	NS	2.5	Refer to Table 2	Refer to Table 2	1.21	2.5
2,3,6-TrCB (24)	55702-45-9	NS	5.0	Refer to Table 2	Refer to Table 2	0.822[9]	5.0

QAPP Worksheet #15-2 (November 2013 & Summer 2015 Mobilizations)
Reference Limits and Evaluation Table

Matrix: Sediment or Soil

Analytical Group: PCB Congeners

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (ng/kg)*	Project Quantitation Limit (ng/kg)	Analytical Method EPA Method 1668C		Achievable Laboratory Limits	
				MDLs* (ng/kg)	Method QLs* (ng/kg)	MDLs (ng/kg)[1]	QLs[2] (ng/kg)
2,3',4-TrCB (25)	55712-37-3	NS	2.5	Refer to Table 2	Refer to Table 2	1.82	2.5
2,3',5-TrCB (26)	38444-81-4	NS	2.5	Refer to Table 2	Refer to Table 2	1.51	2.5
2,3',6-TrCB (27)	38444-76-7	NS	5.0	Refer to Table 2	Refer to Table 2	0.822[9]	5.0
2,4,4'-TrCB (28)	7012-37-5	NS	2.5	Refer to Table 2	Refer to Table 2	2.42	2.5
2,4,5-TrCB (29)	15862-07-4	NS	2.5	Refer to Table 2	Refer to Table 2	0.984	2.5
2,4,6-TrCB (30)	35693-92-6	NS	2.5	Refer to Table 2	Refer to Table 2	0.681	2.5
2,4',5-TrCB (31)	16606-02-3	NS	2.5	Refer to Table 2	Refer to Table 2	1.54	2.5
2,4',6-TrCB (32)	38444-77-8	NS	5.0	Refer to Table 2	Refer to Table 2	1.30[7]	5.0
2',3,4-TrCB (33)	38444-86-9	NS	7.5	Refer to Table 2	Refer to Table 2	2.38[8]	7.5
2',3,5-TrCB (34)	37680-68-5	NS	2.5	Refer to Table 2	Refer to Table 2	1.26	2.5
3,3',4-TrCB (35)	37680-69-6	NS	2.5	Refer to Table 2	Refer to Table 2	1.29	2.5
3,3',5-TrCB (36)	38444-87-0	NS	2.5	Refer to Table 2	Refer to Table 2	0.910	2.5
3,4,4'-TrCB (37)	38444-90-5	NS	2.5	Refer to Table 2	Refer to Table 2	1.63	2.5
3,4,5-TrCB (38)	53555-66-1	NS	2.5	Refer to Table 2	Refer to Table 2	0.768	2.5
3,4',5-TrCB (39)	38444-88-1	NS	2.5	Refer to Table 2	Refer to Table 2	1.19	2.5
2,2',3,3'-TeCB (40)	38444-93-8	NS	2.5	Refer to Table 2	Refer to Table 2	1.28	2.5
2,2',3,4-TeCB (41)	52663-59-9	NS	10.0	Refer to Table 2	Refer to Table 2	3.90[10]	10.0
2,2',3,4'-TeCB (42)	36559-22-5	NS	5.0	Refer to Table 2	Refer to Table 2	1.97[11]	5.0
2,2',3,5-TeCB (43)	70362-46-8	NS	5.0	Refer to Table 2	Refer to Table 2	2.03[12]	5.0
2,2',3,5'-TeCB (44)	41464-39-5	NS	2.5	Refer to Table 2	Refer to Table 2	1.08	2.5
2,2',3,6-TeCB (45)	70362-45-7	NS	2.5	Refer to Table 2	Refer to Table 2	1.13	2.5
2,2',3,6'-TeCB (46)	41464-47-5	NS	2.5	Refer to Table 2	Refer to Table 2	0.468	2.5
2,2',4,4'-TeCB (47)	2437-79-8	NS	2.5	Refer to Table 2	Refer to Table 2	1.57	2.5
2,2',4,5-TeCB (48)	70362-47-9	NS	5.0	Refer to Table 2	Refer to Table 2	1.55[13]	5.0
2,2',4,5'-TeCB (49)	41464-40-8	NS	5.0	Refer to Table 2	Refer to Table 2	2.03[12]	5.0
2,2',4,6-TeCB (50)	62796-65-0	NS	2.5	Refer to Table 2	Refer to Table 2	0.825	2.5

QAPP Worksheet #15-2 (November 2013 & Summer 2015 Mobilizations)
Reference Limits and Evaluation Table

Matrix: Sediment or Soil

Analytical Group: PCB Congeners

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (ng/kg)*	Project Quantitation Limit (ng/kg)	Analytical Method EPA Method 1668C		Achievable Laboratory Limits	
				MDLs* (ng/kg)	Method QLs* (ng/kg)	MDLs (ng/kg)[1]	QLs[2] (ng/kg)
2,2',4,6'-TeCB (51)	68194-04-7	NS	2.5	Refer to Table 2	Refer to Table 2	1.47	2.5
2,2',5,5'-TeCB (52)	35693-99-3	NS	5.0	Refer to Table 2	Refer to Table 2	2.03[14]	5.0
2,2',5,6'-TeCB (53)	41464-41-9	NS	2.5	Refer to Table 2	Refer to Table 2	1.11	2.5
2,2',6,6'-TeCB (54)	15968-05-5	NS	2.5	Refer to Table 2	Refer to Table 2	0.613	2.5
2,3,3',4'-TeCB (55)	74338-24-2	NS	2.5	Refer to Table 2	Refer to Table 2	1.08	2.5
2,3,3',4'-TeCB (56)	41464-43-1	NS	5.0	Refer to Table 2	Refer to Table 2	1.85[15]	5.0
2,3,3',5-TeCB (57)	70424-67-8	NS	2.5	Refer to Table 2	Refer to Table 2	1.13	2.5
2,3,3',5-TeCB (58)	41464-49-7	NS	2.5	Refer to Table 2	Refer to Table 2	2.04	2.5
2,3,3',6-TeCB (59)	74472-33-6	NS	5.0	Refer to Table 2	Refer to Table 2	1.97[11]	5.0
2,3,4,4'-TeCB (60)	33025-41-1	NS	5.0	Refer to Table 2	Refer to Table 2	1.85[15]	5.0
2,3,4,5-TeCB (61)	33284-53-6	NS	5.0	Refer to Table 2	Refer to Table 2	2.96[16]	5.0
2,3,4,6-TeCB (62)	54230-22-7	NS	2.5	Refer to Table 2	Refer to Table 2	0.944	2.5
2,3,4',5-TeCB (63)	74472-34-7	NS	2.5	Refer to Table 2	Refer to Table 2	1.12	2.5
2,3,4',6-TeCB (64)	52663-58-8	NS	10.0	Refer to Table 2	Refer to Table 2	3.90[10]	10.0
2,3,5,6-TeCB (65)	33284-54-7	NS	2.5	Refer to Table 2	Refer to Table 2	0.840	2.5
2,3',4,4'-TeCB (66)	32598-10-0	NS	5.0	Refer to Table 2	Refer to Table 2	2.88[17]	5.0
2,3',4,5-TeCB (67)	73575-53-8	NS	2.5	Refer to Table 2	Refer to Table 2	1.19	2.5
2,3',4,5'-TeCB (68)	73575-52-7	NS	2.5	Refer to Table 2	Refer to Table 2	1.32	2.5
2,3',4,6-TeCB (69)	60233-24-1	NS	5.0	Refer to Table 2	Refer to Table 2	2.03[14]	5.0
2,3'4'5-TeCB (70)	32598-11-1	NS	2.5	Refer to Table 2	Refer to Table 2	2.96[16]	2.5
2,3',4',6-TeCB (71)	41464-46-4	NS	10.0	Refer to Table 2	Refer to Table 2	3.90[10]	10.0
2,3',5,5'-TeCB (72)	41464-42-0	NS	10.0	Refer to Table 2	Refer to Table 2	3.90[10]	10.0
2,3',5',6-TeCB (73)	74338-23-1	NS	2.5	Refer to Table 2	Refer to Table 2	1.28	2.5
2,4,4',5-TeCB (74)	32690-93-0	NS	2.5	Refer to Table 2	Refer to Table 2	0.864	2.5
2,4,4',6-TeCB (75)	32598-12-2	NS	5.0	Refer to Table 2	Refer to Table 2	1.55[13]	5.0
2',3,4,5-TeCB (76)	70362-48-0	NS	5.0	Refer to Table 2	Refer to Table 2	2.88[17]	5.0

QAPP Worksheet #15-2 (November 2013 & Summer 2015 Mobilizations)
Reference Limits and Evaluation Table

Matrix: Sediment or Soil

Analytical Group: PCB Congeners

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (ng/kg)*	Project Quantitation Limit (ng/kg)	Analytical Method EPA Method 1668C		Achievable Laboratory Limits	
				MDLs* (ng/kg)	Method QLs* (ng/kg)	MDLs (ng/kg)[1]	QLs[2] (ng/kg)
3,3',4,4'-TeCB (77)	32598-13-3	NS	2.5	Refer to Table 2	Refer to Table 2	1.95	2.5
3,3',4,5-TeCB (78)	70362-49-1	NS	2.5	Refer to Table 2	Refer to Table 2	1.51	2.5
3,3',4,5'-TeCB (79)	41464-48-6	NS	2.5	Refer to Table 2	Refer to Table 2	1.35	2.5
3,3',5,5'-TeCB (80)	33284-52-5	NS	2.5	Refer to Table 2	Refer to Table 2	1.05	2.5
3,4,4',5-TeCB (81)	70362-50-4	NS	2.5	Refer to Table 2	Refer to Table 2	1.63	2.5
2,2',3,3',4-PeCB (82)	52663-62-4	NS	2.5	Refer to Table 2	Refer to Table 2	1.64	2.5
2,2',3,3',5-PeCB (83)	60145-20-2	NS	2.5	Refer to Table 2	Refer to Table 2	0.737	2.5
2,2',3,3',6-PeCB (84)	52663-60-2	NS	5.0	Refer to Table 2	Refer to Table 2	0.837[18]	5.0
2,2',3,4,4'-PeCB (85)	65510-45-4	NS	5.0	Refer to Table 2	Refer to Table 2	0.783[19]	5.0
2,2'3,4,5-PeCB (86)	55312-69-1	NS	2.5	Refer to Table 2	Refer to Table 2	1.80	2.5
2,2',3,4,5'-PeCB (87)	38380-02-8	NS	7.5	Refer to Table 2	Refer to Table 2	1.30[20]	7.5
2,2',3,4,6-PeCB (88)	55215-17-3	NS	5.0	Refer to Table 2	Refer to Table 2	3.56[21]	5.0
2,2',3,4,6'-PeCB (89)	73575-57-2	NS	2.5	Refer to Table 2	Refer to Table 2	0.676	2.5
2,2',3,4',5-PeCB (90)	68194-07-0	NS	5.0	Refer to Table 2	Refer to Table 2	1.93[22]	5.0
2,2',3,4',6-PeCB (91)	68194-05-8	NS	5.0	Refer to Table 2	Refer to Table 2	3.56[21]	5.0
2,2',3,5,5'-PeCB (92)	52663-61-3	NS	10.0	Refer to Table 2	Refer to Table 2	0.837[18]	10.0
2,2',3,5,6-PeCB (93)	73575-56-1	NS	2.5	Refer to Table 2	Refer to Table 2	2.37	2.5
2,2',3,5,6'-PeCB (94)	73575-55-0	NS	2.5	Refer to Table 2	Refer to Table 2	1.07	2.5
2,2',3,5',6-PeCB (95)	38379-99-6	NS	7.5	Refer to Table 2	Refer to Table 2	1.74[23]	7.5
2,2',3,6,6'-PeCB (96)	73575-54-9	NS	2.5	Refer to Table 2	Refer to Table 2	0.747	2.5
2,2',3,4,5-PeCB (97)	41464-51-1	NS	2.5	Refer to Table 2	Refer to Table 2	1.05	2.5
2,2',3',4,6-PeCB (98)	60233-25-2	NS	7.5	Refer to Table 2	Refer to Table 2	1.74[23]	7.5
2,2',4,4',5-PeCB (99)	38380-01-7	NS	2.5	Refer to Table 2	Refer to Table 2	1.46	2.5
2,2',4,4',6-PeCB (100)	39485-83-1	NS	2.5	Refer to Table 2	Refer to Table 2	0.896	2.5
2,2',4,5'5'-PeCB (101)	37680-73-2	NS	5.0	Refer to Table 2	Refer to Table 2	1.93[22]	5.0
2,2',4,5,6'-PeCB (102)	68194-06-9	NS	7.5	Refer to Table 2	Refer to Table 2	1.74[23]	7.5

QAPP Worksheet #15-2 (November 2013 & Summer 2015 Mobilizations)
Reference Limits and Evaluation Table

Matrix: Sediment or Soil

Analytical Group: PCB Congeners

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (ng/kg)*	Project Quantitation Limit (ng/kg)	Analytical Method EPA Method 1668C		Achievable Laboratory Limits	
				MDLs* (ng/kg)	Method QLs* (ng/kg)	MDLs (ng/kg)[1]	QLs[2] (ng/kg)
2,2',4,5',6-PeCB (103)	60145-21-3	NS	2.5	Refer to Table 2	Refer to Table 2	0.670	2.5
2,2',4,6,6'-PeCB (104)	56558-16-8	NS	2.5	Refer to Table 2	Refer to Table 2	0.397	2.5
2,3,3',4,4'-PeCB (105)	32598-14-4	NS	2.5	Refer to Table 2	Refer to Table 2	1.39	2.5
2,3,3',4,5-PeCB (106)	70424-69-0	NS	5.0	Refer to Table 2	Refer to Table 2	3.32[24]	5.0
2,3,3',4',5-PeCB (107)	70424-68-9	NS	5.0	Refer to Table 2	Refer to Table 2	1.36[25]	5.0
2,3,3',4,5'-PeCB (108)	70362-41-3	NS	5.0	Refer to Table 2	Refer to Table 2	1.99[26]	5.0
2,3,3',4,6-PeCB (109)	74472-35-8	NS	5.0	Refer to Table 2	Refer to Table 2	1.36[25]	5.0
2,3,3'4',6-PeCB (110)	38380-03-9	NS	2.5	Refer to Table 2	Refer to Table 2	1.66	2.5
2,3,3',5,5'-PeCB (111)	39635-32-0	NS	5.0	Refer to Table 2	Refer to Table 2	1.60[27]	5.0
2,3,3',5,6-PeCB (112)	74472-36-9	NS	5.0	Refer to Table 2	Refer to Table 2	1.99[26]	5.0
2,3,3',5',6-PeCB (113)	68194-10-5	NS	2.5	Refer to Table 2	Refer to Table 2	1.16	2.5
2,3,4,4',5-PeCB (114)	74472-37-0	NS	2.5	Refer to Table 2	Refer to Table 2	1.06	2.5
2,3,4,4',6-PeCB (115)	74472-38-1	NS	5.0	Refer to Table 2	Refer to Table 2	1.60[27]	5.0
2,3,4,5,6-PeCB (116)	18259-05-7	NS	5.0	Refer to Table 2	Refer to Table 2	0.783[19]	5.0
2,3,4',5,6-PeCB (117)	68194-11-6	NS	7.5	Refer to Table 2	Refer to Table 2	1.30[20]	7.5
2,3',4,4',5-PeCB (118)	31508-00-6	NS	5.0	Refer to Table 2	Refer to Table 2	3.32[24]	5.0
2,3',4,4',6-PeCB (119)	56558-17-9	NS	2.5	Refer to Table 2	Refer to Table 2	1.96	2.5
2,3',4,5,5'-PeCB (120)	68194-12-7	NS	2.5	Refer to Table 2	Refer to Table 2	0.953	2.5
2,3',4,5',6-PeCB (121)	56558-18-0	NS	2.5	Refer to Table 2	Refer to Table 2	1.49	2.5
2',3,3',4',5'-PeCB(122)	76842-07-4	NS	2.5	Refer to Table 2	Refer to Table 2	1.25	2.5
2,3',4,4',5'-PeCB (123)	65510-44-3	NS	2.5	Refer to Table 2	Refer to Table 2	1.45	2.5
2,3',4',5,5'-PeCB (124)	70424-70-3	NS	2.5	Refer to Table 2	Refer to Table 2	1.33	2.5
2,3',4'5',6-PeCB (125)	74472-39-2	NS	7.5	Refer to Table 2	Refer to Table 2	1.30[20]	7.5
3,3',4,4',5-PeCB (126)	57465-28-8	NS	2.5	Refer to Table 2	Refer to Table 2	0.783	2.5
3,3',4,5,5'-PeCB (127)	39635-33-1	NS	2.5	Refer to Table 2	Refer to Table 2	1.15	2.5
2,2',3,3',4,4'-HxCB (128)	38380-07-3	NS	5.0	Refer to Table 2	Refer to Table 2	1.52[28]	5.0

QAPP Worksheet #15-2 (November 2013 & Summer 2015 Mobilizations)
Reference Limits and Evaluation Table

Matrix: Sediment or Soil

Analytical Group: PCB Congeners

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (ng/kg)*	Project Quantitation Limit (ng/kg)	Analytical Method EPA Method 1668C		Achievable Laboratory Limits	
				MDLs* (ng/kg)	Method QLs* (ng/kg)	MDLs (ng/kg)[1]	QLs[2] (ng/kg)
2,2',3,3',4,5-HxCB (129)	55215-18-4	NS	2.5	Refer to Table 2	Refer to Table 2	1.33	2.5
2,2',3,3',4,5'-HxCB (130)	52663-66-8	NS	2.5	Refer to Table 2	Refer to Table 2	1.55	2.5
2,2',3,3',4,6-HxCB (131)	61798-70-7	NS	2.5	Refer to Table 2	Refer to Table 2	0.780	2.5
2,2',3,3',4,6'-HxCB (132)	38380-05-1	NS	5.0	Refer to Table 2	Refer to Table 2	1.42[29]	5.0
2,2',3,3',5,5'-HxCB (133)	35694-04-3	NS	5.0	Refer to Table 2	Refer to Table 2	1.99[30]	5.0
2,2',3,3',5,6-HxCB (134)	52704-70-8	NS	5.0	Refer to Table 2	Refer to Table 2	1.54[31]	5.0
2,2',3,3',5,6'-HxCB (135)	52744-13-5	NS	2.5	Refer to Table 2	Refer to Table 2	0.842	2.5
2,2',3,3',6,6'-HxCB (136)	38411-22-2	NS	2.5	Refer to Table 2	Refer to Table 2	0.995	2.5
2,2',3,4,4',5-HxCB (137)	35694-06-5	NS	2.5	Refer to Table 2	Refer to Table 2	1.76	2.5
2,2',3,4,4',5'-HxCB (138)	35065-28-2	NS	7.5	Refer to Table 2	Refer to Table 2	1.24[32]	7.5
2,2',3,4,4',6-HxCB (139)	56030-56-9	NS	5.0	Refer to Table 2	Refer to Table 2	1.81[33]	5.0
2,2',3,4,4',6'-HxCB (140)	59291-64-4	NS	2.5	Refer to Table 2	Refer to Table 2	1.15	2.5
2,2',3,4,5,5'-HxCB (141)	52712-04-6	NS	2.5	Refer to Table 2	Refer to Table 2	1.15	2.5
2,2',3,4,5,6-HxCB (142)	41411-61-4	NS	5.0	Refer to Table 2	Refer to Table 2	1.99[30]	5.0
2,2',3,4,5,6'-HxCB (143)	68194-15-0	NS	5.0	Refer to Table 2	Refer to Table 2	1.54[31]	5.0
2,2',3,4,5',6-HxCB (144)	68194-14-9	NS	2.5	Refer to Table 2	Refer to Table 2	1.29	2.5
2,2',3,4,6,6'-HxCB (145)	74472-40-5	NS	2.5	Refer to Table 2	Refer to Table 2	0.555	2.5
2,2',3,4',5,5'-HxCB (146)	51908-16-8	NS	5.0	Refer to Table 2	Refer to Table 2	2.02[34]	5.0
2,2',3,4',5,6-HxCB (147)	68194-13-8	NS	2.5	Refer to Table 2	Refer to Table 2	1.04	2.5
2,2',3,4',5,6'-HxCB (148)	74472-41-6	NS	2.5	Refer to Table 2	Refer to Table 2	1.53	2.5
2,2',3,4',5',6-HxCB (149)	38380-04-0	NS	5.0	Refer to Table 2	Refer to Table 2	1.81[33]	5.0
2,2',3,4',6,6'-HxCB (150)	68194-08-1	NS	2.5	Refer to Table 2	Refer to Table 2	0.934	2.5
2,2',3,5,5',6-HxCB (151)	52663-63-5	NS	2.5	Refer to Table 2	Refer to Table 2	0.959	2.5
2,2',3,5,6,6'-HxCB (152)	68194-09-2	NS	2.5	Refer to Table 2	Refer to Table 2	0.994	2.5
2,2',4,4',5,5'-HxCB (153)	35065-27-1	NS	2.5	Refer to Table 2	Refer to Table 2	1.11	2.5
2,2',4,4',5',6-HxCB (154)	60145-22-4	NS	2.5	Refer to Table 2	Refer to Table 2	0.785	2.5

QAPP Worksheet #15-2 (November 2013 & Summer 2015 Mobilizations)
Reference Limits and Evaluation Table

Matrix: Sediment or Soil

Analytical Group: PCB Congeners

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (ng/kg)*	Project Quantitation Limit (ng/kg)	Analytical Method EPA Method 1668C		Achievable Laboratory Limits	
				MDLs* (ng/kg)	Method QLs* (ng/kg)	MDLs (ng/kg)[1]	QLs[2] (ng/kg)
2,2',4,4',6,6'-HxCB (155)	33979-03-2	NS	2.5	Refer to Table 2	Refer to Table 2	1.02	2.5
2,3,3',4,4',5-HxCB (156)	38380-08-4	NS	2.5	Refer to Table 2	Refer to Table 2	1.31	2.5
2,3,3',4,4',5'-HxCB (157)	69782-90-7	NS	2.5	Refer to Table 2	Refer to Table 2	0.670	2.5
2,3,3',4,4',6-HxCB (158)	74472-42-7	NS	5.0	Refer to Table 2	Refer to Table 2	0.962[35]	5.0
2,3,3',4,5,5'-HxCB (159)	39635-35-3	NS	2.5	Refer to Table 2	Refer to Table 2	0.857	2.5
2,3,3',4,5,6-HxCB (160)	41411-62-5	NS	5.0	Refer to Table 2	Refer to Table 2	0.962[35]	5.0
2,3,3',4,5',6-HxCB (161)	74472-43-8	NS	5.0	Refer to Table 2	Refer to Table 2	1.42[29]	5.0
2,3,3',4',5,5'-HxCB (162)	39635-34-2	NS	5.0	Refer to Table 2	Refer to Table 2	1.52[28]	5.0
2,3,3',4',5,6-HxCB (163)	74472-44-9	NS	7.5	Refer to Table 2	Refer to Table 2	1.24[32]	7.5
2,3,3',4',5',6-HxCB (164)	74472-45-0	NS	7.5	Refer to Table 2	Refer to Table 2	1.24[32]	7.5
2,3,3',5,5',6-HxCB (165)	74472-46-1	NS	5.0	Refer to Table 2	Refer to Table 2	2.02[34]	5.0
2,3,4,4',5,6-HxCB (166)	41411-63-6	NS	2.5	Refer to Table 2	Refer to Table 2	0.737	2.5
2,3',4,4',5,5'-HxCB (167)	52663-72-6	NS	2.5	Refer to Table 2	Refer to Table 2	1.17	2.5
2,3',4,4',5',6-HxCB (168)	59291-65-5	NS	2.5	Refer to Table 2	Refer to Table 2	0.813	2.5
3,3',4,4',5,5'-HxCB (169)	32774-16-6	NS	2.5	Refer to Table 2	Refer to Table 2	0.743	2.5
2,2',3,3',4,4',5-HpCB (170)	35065-30-6	NS	2.5	Refer to Table 2	Refer to Table 2	0.566	2.5
2,2',3,3',4,4',6-HpCB (171)	52663-71-5	NS	2.5	Refer to Table 2	Refer to Table 2	0.876	2.5
2,2',3,3',4,5,5'-HpCB (172)	52663-74-8	NS	2.5	Refer to Table 2	Refer to Table 2	0.513	2.5
2,2',3,3',4,5,6-HpCB (173)	68194-16-1	NS	2.5	Refer to Table 2	Refer to Table 2	1.27	2.5
2,2',3,3',4,5,6'-HpCB (174)	38411-25-5	NS	2.5	Refer to Table 2	Refer to Table 2	1.14	2.5
2,2',3,3',4,5',6-HpCB (175)	40186-70-7	NS	2.5	Refer to Table 2	Refer to Table 2	1.19	2.5
2,2',3,3',4,6,6'-HpCB (176)	52663-65-7	NS	2.5	Refer to Table 2	Refer to Table 2	1.06	2.5
2,2',3,3',4',5,6-HpCB (177)	52663-70-4	NS	2.5	Refer to Table 2	Refer to Table 2	1.41	2.5
2,2',3,3',5,5',6-HpCB (178)	52663-67-9	NS	2.5	Refer to Table 2	Refer to Table 2	0.600	2.5
2,2',3,3',5,6,6'-HpCB (179)	52663-64-6	NS	2.5	Refer to Table 2	Refer to Table 2	0.627	2.5
2,2',3,4,4',5,5'-HpCB (180)	35065-29-3	NS	2.5	Refer to Table 2	Refer to Table 2	0.956	2.5

QAPP Worksheet #15-2 (November 2013 & Summer 2015 Mobilizations)
Reference Limits and Evaluation Table

Matrix: Sediment or Soil

Analytical Group: PCB Congeners

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (ng/kg)*	Project Quantitation Limit (ng/kg)	Analytical Method EPA Method 1668C		Achievable Laboratory Limits	
				MDLs* (ng/kg)	Method QLs* (ng/kg)	MDLs (ng/kg)[1]	QLs[2] (ng/kg)
2,2',3,4,4',5,6-HpCB (181)	74472-47-2	NS	2.5	Refer to Table 2	Refer to Table 2	1.28	2.5
2,2',3,4,4',5,6'-HpCB (182)	60145-23-5	NS	5.0	Refer to Table 2	Refer to Table 2	0.796[36]	5.0
2,2',3,4,4',5',6-HpCB (183)	52663-69-1	NS	2.5	Refer to Table 2	Refer to Table 2	1.11	2.5
2,2',3,4,4',6,6'-HpCB (184)	74472-48-3	NS	2.5	Refer to Table 2	Refer to Table 2	1.02	2.5
2,2',3,4,5,5',6-HpCB (185)	52712-05-7	NS	2.5	Refer to Table 2	Refer to Table 2	0.896	2.5
2,2',3,4,5,5',6-HpCB (186)	74472-49-4	NS	2.5	Refer to Table 2	Refer to Table 2	0.908	2.5
2,2',3,4,5,5',6-HpCB (187)	52663-68-0	NS	5.0	Refer to Table 2	Refer to Table 2	0.796[36]	5.0
2,2',3,4,5,5',6-HpCB (188)	74487-85-7	NS	2.5	Refer to Table 2	Refer to Table 2	0.593	2.5
2,3,3',4,4',5,5'-HpCB (189)	39635-31-9	NS	2.5	Refer to Table 2	Refer to Table 2	0.825	2.5
2,3,3',4,4',5,6-HpCB (190)	41411-64-7	NS	2.5	Refer to Table 2	Refer to Table 2	0.680	2.5
2,3,3',4,4',5',6-HpCB (191)	74472-50-7	NS	2.5	Refer to Table 2	Refer to Table 2	0.873	2.5
2,3,3',4,5,5',6-HpCB (192)	74472-51-8	NS	2.5	Refer to Table 2	Refer to Table 2	0.417	2.5
2,3,3',4',5,5',6-HpCB (193)	69782-91-8	NS	2.5	Refer to Table 2	Refer to Table 2	0.607	2.5
2,2',3,3',4,4',5,5'-OcCB (194)	35694-08-7	NS	2.5	Refer to Table 2	Refer to Table 2	0.432	2.5
2,2',3,3',4,4',5,6-OcCB (195)	52663-78-2	NS	2.5	Refer to Table 2	Refer to Table 2	1.18	2.5
2,2',3,3',4,4',5,6'-OcCB (196)	42740-50-1	NS	5.0	Refer to Table 2	Refer to Table 2	2.50[37]	5.0
2,2',3,3',4,4',6,6'-OcCB (197)	33091-17-7	NS	2.5	Refer to Table 2	Refer to Table 2	0.864	2.5
2,2',3,3',4,5,5',6-OcCB (198)	68194-17-2	NS	2.5	Refer to Table 2	Refer to Table 2	0.809	2.5
2,2',3,3',4,5,5',6'-OcCB (199)	52663-75-9	NS	2.5	Refer to Table 2	Refer to Table 2	1.99	2.5
2,2',3,3',4,5,6,6'-OcCB (200)	52663-73-7	NS	2.5	Refer to Table 2	Refer to Table 2	1.13	2.5
2,2',3,3',4,5',6,6'-OcCB (201)	40186-71-8	NS	2.5	Refer to Table 2	Refer to Table 2	0.627	2.5
2,2',3,3',5,5',6,6'-OcCB (202)	2136-99-4	NS	2.5	Refer to Table 2	Refer to Table 2	1.01	2.5
2,2',3,4,4',5,5',6-OcCB (203)	52663-76-0	NS	5.0	Refer to Table 2	Refer to Table 2	2.50[37]	5.0
2,2',3,4,4',5,6,6'-OcCB (204)	74472-52-9	NS	2.5	Refer to Table 2	Refer to Table 2	0.872	2.5
2,3,3',4,4',5,5',6-OcCB (205)	74472-53-0	NS	2.5	Refer to Table 2	Refer to Table 2	0.854	2.5

QAPP Worksheet #15-2 (November 2013 & Summer 2015 Mobilizations)
Reference Limits and Evaluation Table

Matrix: Sediment or Soil

Analytical Group: PCB Congeners

Concentration Level: Low

Analyte	CAS Number	Project Action Limit (ng/kg)*	Project Quantitation Limit (ng/kg)	Analytical Method EPA Method 1668C		Achievable Laboratory Limits	
				MDLs* (ng/kg)	Method QLs* (ng/kg)	MDLs (ng/kg)[1]	QLs[2] (ng/kg)
2,2',3,3',4,4',5,5',6-NoCB (206)	40186-72-9	NS	2.5	Refer to Table 2	Refer to Table 2	0.733	2.5
2,2',3,3',4,4',5, 6,6'-NoCB (207)	52663-79-3	NS	2.5	Refer to Table 2	Refer to Table 2	0.370	2.5
2,2',3,3',4,5,5',6,6'-NoCB (208)	52663-77-1	NS	2.5	Refer to Table 2	Refer to Table 2	0.640	2.5
DeCB (209)	2051-24-3	NS	2.65	Refer to Table 2	Refer to Table 2	0.941	2.5

ng/kg = nanograms per kilogram
NS = Not Specified
NA = Not available or not applicable
*Refers to Table 2 in EPA Method 1668C.
[1]Based on LOD/LOQ Study from Vista Analytical dated 8/26/2013
[2]Final QL will be adjusted based on the total solids content for each sample.
[3] MDL represents PCB 4/10, [4] MDL represents PCB 5/8, [5] MDL represents PCB 7/9, [6] MDL represents PCB 12/13, [7] MDL represents PCB 16/32, [8] MDL represents PCB 20/21/33, [9] MDL represents PCB 24/27, [10] MDL represents PCB 41/64/71/72, [11] MDL represents PCB 42/59, [12] MDL represents PCB 43/49, [13] MDL represents PCB 48/75, [14] MDL represents PCB 52/69, [15] MDL represents PCB 56/60, [16] MDL represents PCB 61/70, [17] MDL represents PCB 76/66, [18] MDL represents PCB 84/92, [19] MDL represents PCB 85/116, [20] MDL represents PCB 87/117/125, [21] MDL represents PCB 88/91, [22] MDL represents PCB 90/101, [23] MDL represents PCB 95/98/102, [24] MDL represents PCB 106/118, [25] MDL represents PCB 107/109, [26] MDL represents PCB 108/112, [27] MDL represents PCB 111/115, [28] MDL represents PCB 128/162, [29] MDL represents PCB 132/161, [30] MDL represents PCB 133/142, [31] MDL represents PCB 134/143, [32] MDL represents PCB 138/163/164, [33] MDL represents PCB 139/149, [34] MDL represents PCB 146/165, [35] MDL represents PCB 158/160, [36]MDL represents PCB 182/187, [37] MDL represents PCB 196/203.

QAPP Worksheet #15-3 (November 2013 & Summer 2015 Mobilizations)
Reference Limits and Evaluation Table

Matrix: Sediment or Soil

Analytical Group: HCX

Concentration Level: Low

Analyte	CAS Number	Project Action Limit * (ng/kg)	Project Quantitation Limit (ng/kg)	Analytical Method Vista SOP #41 (Rev. 2)		Achievable Laboratory Limits	
				MDLs (ng/kg)	Method QLs (ng/kg)	MDLs[1] (ng/kg)	QLs (ng/kg)
124578-Hexachloroxanthene	38178-99-3	NS	20.0	NS	20.0	15.0	20.0

*Based on LOD study from Vista dated 11/19/2013
NS = Not Specified
ng/kg = nanograms per kilogram

QAPP Worksheet #15-4 (November 2013 & Summer 2015 Mobilizations)
Reference Limits and Evaluation Table

Matrix: Sediment or Soil

Analytical Group: HCP

Concentration Level: Low

Analyte	CAS Number	Project Action Limit * (µg/kg)	Project Quantitation Limit (µg/kg)	Analytical Method Vista SOP #50 Rev. 2		Achievable Laboratory Limits	
				MDLs (µg/kg)	Method QLs(µg/kg)	MDLs[1] (µg/kg)	QLs (µg/kg)
Hexachlorophene	70-30-4	NS	0.50	0.279	0.50	0.279	0.50

[1]Based on LOD study from Vista dated 2/13/2014
NS = Not Specified
µg/kg = micrograms per kilogram

QAPP Worksheet #15-5 (November 2013 & Summer 2015 Mobilizations)
Reference Limits and Evaluation Table

Matrix: Sediment or Soil

Analytical Group: TCDT

Concentration Level: Low

Analyte	CAS Number	Project Action Limit * (ng/kg)	Project Quantitation Limit (ng/kg)	Analytical Method Vista SOP #53		Achievable Laboratory Limits	
				MDLs (ng/kg)	Method QLs(ng/kg)	MDLs[1] (ng/kg)	QLs (ng/kg)
2,4,6,8-Tetrachlorodibenzothiophene	134705-49-0	NS	0.500	0.181	0.500	0.181	0.500

NS = Not Specified
ng/kg = nanograms per kilogram
[1]Based on LOD study from Vista dated 3/31/2014

QAPP Worksheet #15-6 (November 2013 Mobilization)
Reference Limits and Evaluation Table

Matrix:	Sediment
Analytical Group:	Radionuclides
Concentration Level:	Low

Analyte	CAS Number	Project Action Limit (pCi/g)	Project Quantitation Limit (pCi/g)	Analytical Method		Achievable Laboratory Limits[3]
				MDLs	Method QLs (pCi/g)	QLs[2] (pCi/g)
Beryllium-7	13966-02-4	NA[1]	0.3	NA	NA	0.3
Cesium-137	10045-97-3	NA[1]	0.10	NA	NA	0.10

NA = not applicable
[1]There are no action levels established for these parameters for this Study.
[2]The target QLs are set at a low level intended to allow for dating of the sediment.
[3]Lab results will be in dry weight. Actual QLs may be higher and are dependent on the amount of sample available and counting time.
pCi/g = picocuries per gram

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #16 (November 2013 Mobilization)
Project Schedule Timeline Table

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Field Sampling Activities (Sediments)	SERAS	11/18/13	11/20/13	Trip Report	14 days following return from the field investigation
Dioxin/Furan, PCB Congeners and total PCBs, HCX, HCP and TCDT Analyses	Vista Analytical	11/20/13	04/21/14	Analytical Data Package	6 weeks after receipt of samples
Cs-137 and Be-7 Analyses	Outreach Lab	11/20/13	01/29/14	Analytical Data Package	35 business days after receipt
Trip Report Preparation	SERAS	11/20/13	12/08/13	Trip Report	14 days following return from the field investigation
Validation of Dioxin/Furan, PCB Congeners and total PCBs, HCX, HCP and TCDT	SERAS	Upon receipt of data package	Within 4 weeks	Analytical Report	Within 4 weeks after receipt of last data package
Validation of Cs-137 and Be-7	SERAS	Upon receipt of data package	Within 4 weeks	Analytical Report	Within 4 weeks after receipt of last data package
Summary Report Preparation	SERAS	Upon receipt of validated data	Within 2 weeks	Draft Summary Report	Within 2 weeks after receipt of validated data

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #16 (Summer 2015 Mobilization)
Project Schedule Timeline Table

Activities	Organization	Dates (MM/DD/YY)		Deliverable	Deliverable Due Date
		Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Field Sampling Activities (Sediments)	SERAS	Summer 2015	Summer 2015	Trip Report	14 days following return from the field investigation
Dioxin/Furan, PCB Congeners and total PCBs, HCX, HCP and TCDT Analyses	Vista Analytical	Summer 2015	Summer 2015	Analytical Data Package	6 weeks after receipt of samples
Trip Report Preparation	SERAS	Summer 2015	Summer 2015	Trip Report	14 days following return from the field investigation
Validation of Dioxin/Furan, PCB Congeners and total PCBs, HCX, HCP and TCDT	SERAS	Upon receipt of data package	Within 4 weeks	Analytical Report	Within 4 weeks after receipt of last data package
Summary Report Preparation	SERAS	Upon receipt of validated data	Within 2 weeks	Draft Summary Report	Within 2 weeks after receipt of validated data

QAPP Worksheet #17 (November 2013 Mobilization)
Sampling Design and Rationale

Describe and provide a rationale for choosing the sampling approach (e.g., grid system, biased statistical approach):
The overall objective of this study is to evaluate if potential sources of contamination found in the sediment deposits at RM 10.9 of the Passaic River may be potentially linked to the former Givaudan or Diamond Alkali facilities. Resource limitations (costly analytical method development and analysis) have led to the development of a focused study design and sample size of 30 for analysis of the contaminants of concern across all targeted locations. These locations include the sediments at Passaic River RM 10.9 and the Third River, and the waste cells present on the former Givaudan and Diamond Alkali facilities. This sampling and analysis plan pertains to the sampling of sediments.

Sediment sampling will be conducted at the following locations:

- "No-dredge zone" portion of the Removal Area,
- Downstream of the designated Removal Area,
- In the region of the confluence of the Third River with the Passaic River
- In the Third River above the Route (Rte.) 21 bridge
- Upstream of the Third and Passaic Rivers confluence near Dundee Dam

These sampling results will be compared to samples which will be collected from the former Givaudan and Diamond Alkali facilities waste cells (note: sampling at the former facilities will be provided in a revision to this document).

The weight of evidence approach which will be used to evaluate the former Givaudan and Diamond Alkali facilities as potential sources of sediment contamination within this stretch of the Passaic will include the computation of contaminant ratios which will act as a method of fingerprinting the waste streams produced by the historical chemical processes of Givaudan and Diamond Alkali. These fingerprints will be compared to the contaminant ratios found within the no dredge zone, below the Removal Area, within the Third River and its confluence with the Passaic River and upstream near the Dundee Dam. The evaluation of chromatographic results (e.g., peak patterns, chemical signatures, etc.) will also be used as a line of evidence.

No-Dredge Zone. Sampling within the Removal Area will occur within the no-dredge zone of the RM 10.9 Removal Area. Dredging activities in the Removal Area were completed on October 4, 2013 and capping is expected to commence during the week of November 4, 2013. The no-dredge zone overlays a known underground water pipe. Historical data from within the no dredge zone is limited to 4 sediment core locations from which samples were collected in 2011. TCDD concentrations were highest at the surface of the sediments, decreasing with depth, and with a significant drop-off below 3.5 feet. PCBs at these 4 locations were also consistently within detectable ranges at surface and down to 2.5 feet. These results indicate that focusing on the top 2 feet of sediments is expected to be useful for the present investigation.

Sediment sampling and analysis for the contaminants of concern will be conducted at the surface (0 to 6 inches) for all four proposed sediment locations. Two sediment cores will be sampled from the 1-3' interval and two samples will be collected from 3-5' interval. Historical data has indicated that both TCDD and PCBs are within detectable ranges at these depth intervals. These samples will be collected from four cores (total of 8 samples) located within the center of the no-dredge zone. Visual Sample Plan (VSP) was used to generate 4 random coordinates within this area. Randomness was included in the sample design to support future comparisons with the Givaudan and Diamond Alkali waste cell results. Coordinates of the cores are below:

X-Coordinate:	Y-Coordinate:
572930.3495	4518941.0445
572917.6358	4518907.5235
572909.6868	4518916.4624
572928.7603	4518923.1666

A core will also be advanced to approximately 4 feet with samples collected every ½ foot, for a total of 8 samples, which will be sent for Cs-137 and Be-7 dating. The sampling depths of the COCs will be linked to a frame of time when the corresponding sediment was deposited in the river.

Downstream of the Removal Area. Examination of the TCDD and PCB analytical results for historical sampling which occurred in the "fingertip" portion (below the removal area) of the sediment deposit area identified high levels of TCDD at depths between 5 ½ to 7 ½ feet with TCDD concentrations as high as 40,800 picograms per gram (pg/g). These samples were collected in 2011. To further investigate these deposits, the present study will collect 3 cores south of the removal area with sample collection occurring from the interval of 6 to 8 feet. Coordinates of the proposed core locations are:

X-Coordinate:	Y-Coordinate:
572753.6416	4518629.4755
572779.7475	4518757.6318
572764.7168	4518698.3002

A core will also be advanced within this area to approximately 8 feet with samples collected every ½ foot, for a total of 16 samples, which will be sent for Cs-137 and Be-7 dating.

Third River. The Third River will be evaluated as a potential transport pathway of waste from the Givaudan facility; however, there are limited historical data regarding COC concentrations within the sediment in the Third River and at its confluence with the Passaic.

It is recommended that 2 cores be advanced into the sediments at the confluence of the Rivers. At this time, no information is available regarding the depth of the sediment within this area. Suggested sampling intervals are surface (0-6 inches) and 1 foot above the bottom of the sediment (to be determined in the field by probing), which will result in another 4 samples for analysis of COCs. An additional core will be advanced in this area, with samples collected every ½' until the bottom of the sediment is reached. These samples will be sent for Cs-137 and Be-7 dating.

It is recommended that three surface sediment samples be collected within the Third River above the Rte. 21 Bridge. Location of these samples will be dependent on the river flow and the actual presence of sediment. In this region, much of the Third River has a rocky, graveled bottom with little sediment.

Upstream Reference Location. One sediment sample will be collected from a location above Dundee Dam, upstream of the confluence of the Third and Passaic Rivers. It is anticipated that samples will be collected from the 0-0.5' and 1-2' intervals. An additional core will be advanced in this area, with samples collected every ½' to 4'. These samples will be sent for Cs-137 and Be-7 dating.

QAPP Worksheet #17 (Summer 2015 Mobilization)
Sampling Design and Rationale

Describe the sampling design and rationale in terms of what matrices will be sampled, what analytical groups will be analyzed and at what concentration levels, the sampling locations (including QC, critical, and background samples), the number of samples to be taken, and the sampling frequency (including seasonal considerations) [May refer to map or Worksheet #18 for details]:

For dioxin-contaminated cell sampling at both locations, SERAS or a SERAS subcontractor will use a Geoprobe to perform drilling activities to collect cores from the two dioxin-contaminated cells. If SERAS uses its own equipment, the Geoprobe MC5 sampling system will be utilized to collect soil cores down to pre-determined depths. A subcontractor may use the same or similar Geoprobe. The MC5 sampling system houses a PVC liner (core) along with an inner-rod, drive head, drive point and cutting shoe, The MC5 is driven as a closed system down to 5 feet and as this is happening the drive point is moving upward within the liner, allowing the soil core to enter the liner. Once the 5 foot core has been collected it is retrieved and then the sample core is extracted. The process may be repeated to reach the desired depth of sampling. The core is then transferred to a table where it will be cut open, logged, homogenized and sampled. All efforts will be made to minimize damage to the geotextile/geomembrane liners during sampling of the respective waste cells. Once the bore hole has been abandoned it will then be grouted to prevent any vertical cross-contamination within the hole.

During sampling the goal will be to collect samples form the highest contaminated cell soil which is located roughly at the center of the cell. Care will be made to minimize damage to the cell structure and to repair any damage afterwards. Lockheed Martin's Insurance information has been forwarded to the Givaudan lawyers. Lockheed Martin/SERAS will be granted access prior to sampling the cell. Equipment and personnel will be staged on the "blacktop" of the cell during the actual sampling process. Focus will therefore be on the center of the cell where soils with higher contamination (greater than 20 ug/kg TCDD) were contained. The surface of the cell will be perforated during sampling but the bottom of the waste cell will not be compromised. The damaged surface of the cell will be repaired where sampled. The asphalt surface will likewise be patched to prevent inflow of surface water during later storm events.

The asphalt will be cut attempting initially to confine the cut to roughly a **2-foot by 2-foot square**, using a STIHL brand or equivalent, gas powered Cut-Off Saw with a diamond blade. The chain link fence below will be cut by hand and the piece of fencing removed and placed aside. Lockheed Martin will use their 6600 DT Geoprobe to collect the samples. The Geoprobe will use a 2.25 outside diameter tool string. Although it is planned to use the 2.25 Geoprobe tooling, the 3.25 tooling will be brought to the location as back up if there are recovery issues and volume of sample issues. Each Rod of the Geoprobe is 5-feet in length, including the sampler. The hole will be centered on the open square and pushed to the desired depth. The probe will then be removed and the sample collected and processed on Site. Split samples were requested by Givaudan. Although we wish to minimize the number of perforations, it may be necessary to make an additional hole or holes alongside the original if there is insufficient sample soil recovery. Portland Type 1 cement will be used for grouting the boring. The grout will be mixed in a bucket with a drill and mixing bit to the desired consistency. The borehole abandonment will be done using the Tremie method. After sampling is completed the boring will be grouted and the machine moved off the hole. The top clean soil will then be removed down to the nonwoven geotextile membrane either by hand or possibly use of a vacuum truck. The geotextile membrane will then be patched with a similar piece of 8 ounce nonwoven geotextile slightly larger than the damaged section. This will overlap and adhere with a high-strength spray adhesive such as 3M Spray Adhesive 90-24. Bentonite and/or other sealant material (e.g. Tremco brand "Paraseal") may be placed on top of the geotextile patch to help seal and provide additional protection to the sampling location. The clean soil will be replaced on the geotextile patch and the asphalt at the surface will be patched. The asphalt patch used to repair the hole will be Sakrete or quickcrete brand all weather blacktop patch or similar. SERAS will use a Vibratory Plate Compactor to tamp down the asphalt patch. Note that it may be necessary to make a larger cut to properly address the membrane cover or to obtain sufficient sample. If the cut asphalt area ends up being considerably larger than Lockheed Martin/SERAS may opt to subcontract a repaver to better repair the damaged asphalt surface.

The sampling effort will focus on the area 6 to 12 feet below ground surface (bgs). Two locations approximately 25-feet apart will be sampled to increase the chance of collecting a sample of interest. Samples will be processed on Site. Givaudan will receive split samples of the homogenized sample material. Surplus sample material, if applicable, will be archived for a period of time at Lockheed Martin/SERAS. Sampling of the Givaudan cell is anticipated to be completed within one day but an additional day (possibly not consecutive) may be necessary for repairing the asphalt, if needed, and unknown or unforeseen circumstances may alter or lengthen this schedule. It will be necessary to perform this sampling when daytime temperatures are reasonably warm and the weather is dry.

The property of the Diamond Alkali Superfund Site and its waste cell is currently managed by Tierra Solutions Inc. Details of the waste cell may be found in Final Remedial Design Drawings Details produced by Eckenfelder Inc. This waste cell is more complicated in structure than the GWC in that it contains numerous buried and hidden structural supports, drums, and debris. Four to six cores will similarly be collected from this waste cell within the general area indicated. Focus will be in the northwest area of the waste cell in the vicinity if the former process building. See Figure 2. This area historically contains the highest contaminated soil and should also be relatively easy to sample without chance of hitting "deadman" and other horizontal structural supports or debris, which occur within much of the cell. The surface of this cell is relatively open over much of it and LM/SERAS or a subcontractor will be able to drive their Geoprobe machine directly on the surface of the cell to access this area. At the surface of the waste cell is approximately five inches of stone. The cell will be accessed and sampled similar to the Givaudan Site, with the surface barriers carefully addressed by hand prior to collecting a core. Below the stone is a geotextile membrane, 18" of clean fill, another geomembrane, 12" of gravel, and finally another geotextile membrane. The actual contents of the cell therefore begin approximately at least 48" below ground surface. The geotextile material was manufactured by TC Mirafi. The surface stone will be carefully removed by hand and set aside to access the uppermost geomembrane. As with the GWC, Lockheed Martin will use their 6600 DT Geoprobe to collect the samples or a subcontractor may use a similar machine. The Geoprobe will use a 2.25 outside diameter tool string. Although it is planned to use the 2.25 Geoprobe tooling, the 3.25 tooling will be brought to the location as back up if there are recovery issues and volume of sample issues. Each rod of the Geoprobe is 5-feet in length, including the sampler. More than one rod can be advanced to reach the desired sampling depth. The hole will be centered on the open square and pushed to the desired depth. The probe will then be removed and the sample collected and processed on Site. Although we wish to minimize the number of perforations, it may be necessary to make an additional hole or holes alongside the original if there is insufficient sample soil recovery. Portland Type 1 cement will be used for grouting the boring. The grout will be mixed in a bucket with a drill and mixing bit to the desired consistency. The borehole abandonment will be done using the *Tremie* method. After sampling is completed the boring will be grouted and the machine moved off the hole. The uppermost geomembrane will be patched in a similar fashion to the GWC. The rest of the hole below this upper membrane will be grouted as indicated to prevent vertical cross contamination..

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #18 (November 2013 Mobilization)
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ID Number	Matrix	Depth (feet)	Analytical Group	Concentration Level	Number of Samples (identify field replicates)**	Sampling SOP Reference[1]	Rationale for Sampling Location
ND-001-0.0-0.5	Sediment	0-0.5	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1+1	SERAS SOP #2016	Based on historical data
ND-001-1.0-3.0	Sediment	1-2	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data
ND-002-0.0-0.5	Sediment	0-0.5	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data
ND-002-1.0-3.0	Sediment	1-2	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data
ND-003-0.0-0.5	Sediment	0-0.5	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data
ND-003-3.0-5.0	Sediment	1-2	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data
ND-004-0.0-0.5	Sediment	0-0.5	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data
ND-004-3.0-5.0	Sediment	1-2	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data
ND-005-0.0-0.5	Sediment	0-0.5	Cs-137 & Be-7	Low	1+1	SERAS SOP #2016	Will be used to date sediment cores

QAPP Worksheet #18 (November 2013 Mobilization)
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ID Number	Matrix	Depth (feet)	Analytical Group	Concentration Level	Number of Samples (identify field replicates)**	Sampling SOP Reference[1]	Rationale for Sampling Location
ND-005-0.5-1.0	Sediment	0.5-1.0	Cs-137 & Be-7	Low	1+1	SERAS SOP #2016	Will be used to date sediment cores
ND-005-1.0-1.5	Sediment	1.0-1.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
ND-005-1.5-2.0	Sediment	1.5-2.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
ND-005-2.0-2.5	Sediment	2.0-2.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
ND-005-2.5-3.0	Sediment	2.5-3.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
ND-005-3.0-3.5	Sediment	3.0-3.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
ND-005-3.5-4.0	Sediment	3.5-4.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
ND-005-4.0-4.5	Sediment	3.5-4.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
ND-005-4.5-5.0	Sediment	3.5-4.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
BRA-001-6.0-8.0	Sediment	6.0-8.0	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data

QAPP Worksheet #18 (November 2013 Mobilization)
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ID Number	Matrix	Depth (feet)	Analytical Group	Concentration Level	Number of Samples (identify field replicates)**	Sampling SOP Reference[1]	Rationale for Sampling Location
BRA-002-6.0-8.0	Sediment	6.0-8.0	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data
BRA-003-6.0-8.0	Sediment	6.0-8.0	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data
BRA-004-0.0-0.5	Sediment	0.0-0.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
BRA-004-0.5-1.0	Sediment	0.5-1.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
BRA-004-1.0-1.5	Sediment	1.0-1.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
BRA-004-1.5-2.0	Sediment	1.5-2.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
BRA-004-2.0-2.5	Sediment	2.0-2.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
BRA-004-2.5-3.0	Sediment	2.5-3.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
BRA-004-3.0-3.5	Sediment	3.0-3.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
BRA-004-3.5-4.0	Sediment	3.5-4.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores

QAPP Worksheet #18 (November 2013 Mobilization)
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ID Number	Matrix	Depth (feet)	Analytical Group	Concentration Level	Number of Samples (identify field replicates)**	Sampling SOP Reference[1]	Rationale for Sampling Location
BRA-004-4.0-4.5	Sediment	4.0-4.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
BRA-004-4.5-5.0	Sediment	4.5-5.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
BRA-004-5.0-5.5	Sediment	5.0-5.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
BRA-004-5.5-6.0	Sediment	5.5-6.0	Cs-137 & Be-7	Low	1+1	SERAS SOP #2016	Will be used to date sediment cores
BRA-004-6.0-6.5	Sediment	6.0-6.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
BRA-004-6.5-7.0	Sediment	6.5-7.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
BRA-004-7.0-7.5	Sediment	7.0-7.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
BRA-004-7.5-8.0	Sediment	7.5-8.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-001-0.0-0.5	Sediment	0-0.5	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data
TRC-001-xx-xx	Sediment	TBD (1 foot above sediment surface	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data

QAPP Worksheet #18 (November 2013 Mobilization)
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ID Number	Matrix	Depth (feet)	Analytical Group	Concentration Level	Number of Samples (identify field replicates)**	Sampling SOP Reference[1]	Rationale for Sampling Location
TRC-002-0.0-0.5	Sediment	0-0.5	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data
TRC-002-xx-xx	Sediment	TBD (1 foot above sediment surface	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data
TRC-003-0.0-0.5	Sediment	0-0.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-003-0.5-1.0	Sediment	0.5-1.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-003-1.0-1.5	Sediment	1.0-1.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-003-1.5-2.0	Sediment	1.5-2.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-003-2.0-2.5	Sediment	2.0-2.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-003-2.5-3.0	Sediment	2.5-3.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-003-3.0-3.5	Sediment	3.0-3.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-003-3.5-4.0	Sediment	3.5-4.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores

QAPP Worksheet #18 (November 2013 Mobilization)
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ID Number	Matrix	Depth (feet)	Analytical Group	Concentration Level	Number of Samples (identify field replicates)**	Sampling SOP Reference[1]	Rationale for Sampling Location
TRC-003-4.0-4.5	Sediment	4.0-4.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-003-4.5-5.0	Sediment	4.5-5.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-003-5.0-5.5	Sediment	5.0-5.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-003-5.5-6.0	Sediment	5.5-6.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-003-6.0-6.5	Sediment	6.0-6.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-003-6.5-7.0	Sediment	6.5-7.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-003-7.0-7.5	Sediment	7.0-7.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Will be used to date sediment cores
TRC-003-7.5-8.0	Sediment	7.5-8.0	Cs-137 & Be-7	Low	1+1	SERAS SOP #2016	Will be used to date sediment cores
TR-001-0.0-0.5	Sediment	0-0.5	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data
TR-002-0.0-0.5	Sediment	0-0.5	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data

QAPP Worksheet #18 (November 2013 Mobilization)
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ID Number	Matrix	Depth (feet)	Analytical Group	Concentration Level	Number of Samples (identify field replicates)**	Sampling SOP Reference[1]	Rationale for Sampling Location
TR-003-0.0.-0.5	Sediment	0-0.5	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Based on historical data
DD-001-0.0-0.5	Sediment	0-0.5	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Upstream reference location
DD-001-1.0-2.0	Sediment	1.0-2.0	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2016	Upstream reference location
DD-002-0.0-0.5	Sediment	0-0.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Upstream reference location
DD-002-0.5-1.0	Sediment	0.5-1.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Upstream reference location
DD-002-1.0-1.5	Sediment	1.0-1.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Upstream reference location
DD-002-1.5-2.0	Sediment	1.5-2.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Upstream reference location
DD-002-2.0-2.5	Sediment	2.0-2.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Upstream reference location
DD-002-2.5-3.0	Sediment	2.5-3.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Upstream reference location
DD-002-3.0-3.5	Sediment	3.0-3.5	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Upstream reference location
DD-002-3.5-4.0	Sediment	3.5-4.0	Cs-137 & Be-7	Low	1	SERAS SOP #2016	Upstream reference location

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #21)

** Field replicates have been arbitrarily selected and will be chosen in the field at the frequency of 1:20 samples and based on mass available. Based on the number of samples listed in Worksheet 18, one field replicate will be collected for TCDD/TCDF, PCB congeners and total PCBs, HCX, HCP and TCDT. Three field replicates will be selected for Cs-137 and Be-7 dating.

ND = No Dredge Zone

Location	X-Coordinate:	Y-Coordinate:
001	572930.3495	4518941.0445
002	572917.6358	4518907.5235
003	572909.6868	4518916.4624
004	572928.7603	4518923.1666

BRA = Downstream of Removal Area

Location	X-Coordinate:	Y-Coordinate:
001	572753.6416	4518629.4755
002	572779.7475	4518757.6318
003	572764.7168	4518698.3002

TRC = Third River and Passaic River Confluence
TR = Third River
DD = Dundee Dam
xx-xx = 1 foot above sediment bottom

QAPP Worksheet #18 (Summer 2015 Mobilization)
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ID Number	Matrix	Depth (feet)	Analytical Group	Concentration Level	Number of Samples (identify field replicates)**	Sampling SOP Reference[1]	Rationale for Sampling Location
GWC-1-xxxx	Soil	TBD	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1+1	SERAS SOP #2012	Based on historical data
GWC-1-xxxx	Soil	TBD	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2012	Based on historical data
GWC-2-xxxx	Soil	TBD	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2012	Based on historical data
GWC-2-xxxx	Soil	TBD	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2012	Based on historical data
DWC-1-xxxx	Soil	TBD	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2012	Based on historical data
DWC-1-xxxx	Soil	TBD	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2012	Based on historical data
DWC-2-xxxx	Soil	TBD	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2012	Based on historical data
DWC-2-xxxx	Soil	TBD	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2012	Based on historical data
DWC-3-xxxx	Soil	TBD	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2012	Based on historical data
DWC-3-xxxx	Soil	TBD	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2012	Based on historical data

QAPP Worksheet #18 (Summer 2015 Mobilization)
Sampling Locations and Methods/SOP Requirements Table

Sampling Location/ID Number	Matrix	Depth (feet)	Analytical Group	Concentration Level	Number of Samples (identify field replicates)**	Sampling SOP Reference[1]	Rationale for Sampling Location
DWC-4-xxxx	Soil	TBD	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2012	Based on historical data
DWC-4-xxxx	Soil	TBD	PCDD/PCDF, PCB Congeners and Total PCBs, HCX, HCP, TCDT	Low	1	SERAS SOP #2012	Based on historical data

GWC – Givaudan Waste Cell
DWC – Diamond Waste Cell
xxxx – depth interval (e.g., 6-8 feet would be 0608
TBD – Specific depth intervals will be determined in the field
** - Replicate will be chosen in the field

NOTE: An additional two cores may be advanced on the DWC depending on the amount of representative material obtained in the planned four cores.

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #19 (November 2013 Mobilization)
Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference [1]	Sample Volume[2]	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Sediment	17 Dioxins/furans + non-2,3,7,8-TCDDs	Low	EPA 1613B	10 grams	8-oz jar	≤-10 degrees C, light protected	Up to 1 year
Sediment	209 PCB Congeners + total PCBs	Low	EPA 1668C	10 grams			
Sediment	HCP	Low	Vista SOP #50, Revision 2.0	10 grams			
Sediment	124578-HCX	Low	Vista SOP #41, Revision 2.0	10 grams	4-oz amber	≤6 degrees C, light protected	14 days from collection/40 days from extraction
Sediment	TCDT	Low	Vista SOP # 53, Revision 0.0	10 grams	8-oz jar amber	≤ 6 degrees C, light protected	Extraction: 1 year from collection, analyze: 1 year from extraction
Sediment	Cs-137 & Be-7	Low	Outreach SOP #RAD_04-11	~200 grams	16-oz plastic sealable bag or equivalent	None	None

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23)
NA = Not available or not applicable
C = Centigrade
☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #19 (Summer 2015 Mobilization)
Analytical SOP Requirements Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation Method/SOP Reference [1]	Sample Volume[2]	Containers (number, size, and type)	Preservation Requirements (chemical, temperature, light protected)	Maximum Holding Time (preparation/ analysis)
Soil	17 Dioxins/furans + non-2,3,7,8-TCDDs	Low	EPA 1613B	10 grams	8-oz jar	≤-10 degrees C, light protected	Up to 1 year
Soil	209 PCB Congeners + total PCBs	Low	EPA 1668C	10 grams			
Soil	HCP	Low	Vista SOP #50, Revision 2.0	10 grams			
Soil	124578-HCX	Low	Vista SOP #41, Revision 2.0	10 grams	4-oz amber	≤6 degrees C, light protected	14 days from collection/40 days from extraction
Soil	TCDT	Low	Vista SOP # 53, Revision 0.0	10 grams	8-oz jar amber	≤ 6 degrees C, light protected	Extraction: 1 year from collection, analyze: 1 year from extraction

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23)
NA = Not available or not applicable
C = Centigrade

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #20 (November 2013 Mobilization)
Field Quality Control Sample Summary Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference[1]	No. of Samples	No. of Field Replicates	No. of MS/MSD	No. of Field Blanks	No. of Equip. Blanks	No. of PT Samples	Total No. of Samples to Lab
Sediment	17 Dioxin/Furans, homologs + non 2,3,7,8-TCDDs/ TCDFs	Low	EPA 1613B	19	1	1	NA	NA	NA	20
Sediment	PCBs Congeners Full List 209 Congeners + total PCBs	Low	EPA 1668C	19	1	1	NA	NA	NA	20
Sediment	HCX	Low	Vista SOP #41	19	1	1	NA	NA	NA	20
Sediment	HCP	Low	Vista SOP #50	19	1	1	NA	NA	NA	20
Sediment	TCDT	LOW	Vista SOP #53	19	1	1	NA	NA	NA	20
Sediment	Cs-137 & Be-7	Low	Outreach SOP #RAD_04-11	48	3	NA	NA	NA	NA	51

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23)
NA = Not applicable

QAPP Worksheet #20 (Summer 2015 Mobilization)
Field Quality Control Sample Summary Table

Matrix	Analytical Group	Concentration Level	Analytical and Preparation SOP Reference[1]	No. of Samples	No. of Field Replicates[2]	No. of MS/MSD	No. of Field Blanks	No. of Equip. Blanks	No. of PT Samples	Total No. of Samples to Lab
Soil	17 Dioxin/Furans, homologs + non 2,3,7,8-TCDDs/ TCDFs	Low	EPA 1613B	12	1	2*	NA	NA	NA	13
Soil	PCBs Congeners Full List 209 Congeners + total PCBs	Low	EPA 1668C	12	1	2*	NA	NA	NA	13
Soil	HCX	Low	Vista SOP #41	12	1	2*	NA	NA	NA	13
Soil	HCP	Low	Vista SOP #50	12	1	2*	NA	NA	NA	13
Soil	TCDT	Low	Vista SOP #53	12	1	2*	NA	NA	NA	13

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23)
NA = Not applicable
*One MS/MSD from each dioxin-contaminated cell

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #21 (November 2013 and Summer 2015 Mobilizations)
Project Sampling SOP References Table

Reference Number	Title, Revision Date and/or Number	Originating Organization	Equipment Type	Modified for Project Work? (Check if yes)	Comments
SERAS SOP #2001	General Field Sampling Guidelines	SERAS	General Sampling	☐	
SERAS SOP #2003	Sample Storage, Preservation and Handling	SERAS	Sample Handling	☐	
SERAS SOP #2002	Sample Documentation	SERAS	NA	☐	
SERAS SOP #2004	Sample Packaging and Shipment	SERAS	NA	☐	
SERAS SOP #4005	Chain of Custody Procedures	SERAS	NA	☐	
SERAS SOP #2016	Sediment Sampling	SERAS	Vibracore	☐	
SERAS SOP #2012	Soil Sampling	SERAS	Geoprobe	☐	

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #22 (November 2013 and Summer 2015 Mobilizations)
Field Equipment Calibration, Maintenance, Testing, and Inspection Table

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference[1]
GPS		As per manufacturer's instructions	As per manufacturer's instructions	Check Battery	Daily	Able to pick up signal	Recharge or replace battery	Field personnel	

[1]Specify the appropriate reference letter or number from the Project Sampling SOP References table (Worksheet #21)

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #23 (November 2013 Mobilization)
Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
EPA 1613B	Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS	Definitive	Dioxin/furans/ homologs	HRGC/HRMS	Vista Analytical	
EPA 1668C	Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by HRGC/HRMS	Definitive	PCB Congeners – full list + total PCBs	HRGC/HRMS	Vista Analytical	
Vista SOP #41, Revision 2	Extraction and Analysis of Hexachloroxanthene by HRMS	Definitive	HCX	GC/HRMS	Vista Analytical	
Vista SOP #50, Revision 2	Preparation and Analysis of Aqueous and Solid Matrices for the Determination of Hexachlorophene	Definitive	HCP	LC/MS/MS	Vista Analytical	
Vista SOP #53, Revision 1	Preparation and Analysis for the Determination of 2,4,6,8-Tetrachlorodibenzothiphene in Solid Matrices	Definitive	TCDT	GC/HRMS	Vista Analytical	
Outreach SOP #RAD_04-11	Sample Analysis by Gamma Spectrometry	Definitive	Cs-137 & Be-7	High purity germanium detector	Outreach Laboratory	

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #23 (Summer 2015 Mobilizations
Analytical SOP References Table

Reference Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Analytical Group	Instrument	Organization Performing Analysis	Modified for Project Work?
EPA 1613B	Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS	Definitive	Dioxin/furans/ homologs/TCDT	HRGC/HRMS	Vista Analytical	
EPA 1668C	Chlorinated Biphenyl Congeners in Water, Soil, Sediment, and Tissue by HRGC/HRMS	Definitive	PCB Congeners – full list + total PCBs	HRGC/HRMS	Vista Analytical	
Vista SOP #41, Revision 2	Extraction and Analysis of Hexachloroxanthene by HRMS	Definitive	HCX	GC/HRMS	Vista Analytical	
Vista SOP #50, Revision 2	Preparation and Analysis of Aqueous and Solid Matrices for the Determination of Hexachlorophene	Definitive	HCP	LC/MS/MS	Vista Analytical	
Vista SOP #53, Revision 1	Preparation and Analysis for the Determination of 2,4,6,8-Tetrachlorodibenzothiphene in Solid Matrices	Definitive	TCDT	GC/HRMS	Vista Analytical	

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #24-1 (November 2013 and Summer 2015 Mobilizations)
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
HRGC/HRMS (dioxins/furans)	Tune using perfluorokerosene (PFK)	Prior to sample analysis	Resolving power ≥10,000 at m/z = 304.9824 or any other reference signal close to m/z 304 (from TCDF). Deviation between the exact m/z and theoretical m/z must be <5ppm	Retune instrument Reanalyze PFK	Vista Analytical Chemist	EPA 1613B
	Column Performance Check Solution (CPCM). Solution includes the Window Defining Mix	Prior to 12 hours of sample analysis	Used to set retention times of first and last eluters. CPCM must have ≤25% valley resolution for 2,3,7,8-TCDD and 2,3,7,8-TCDF	Readjust windows. Evaluate system. Perform maintenance. Reanalyze CPCM.		
	6-Point Initial Calibration (ICAL)	Initially and as required	Ion ratios within Table 9 limits*, and S/N ≥10:1. Absolute retention time of $^{13}C_{12}$-1234-TCDD >25 min on DB-5 column and retention time of $^{13}C_{12}$-1234-TCDD > 15 minutes on DB-225 column	Evaluate system. Recalibrate. If all criteria are met except the ion ratios, evaluate impact and document		
	Daily Continuing Calibration Verification (CCAL)	Once per 12 hours, prior to sample analysis	Analyte concentrations must be within the limits specified in Table 6 of method 1613B.	Evaluate system. Evaluate data for usability. Reanalyze CCAL. Recalibrate (ICAL).		

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23)
*Due to different ions monitored for PeCDD, the ion ratio will differ from the limits in EPA Method Table 9. The M+2 and M+4 are monitored because there is less interference from PCBs.

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #24-2(November 2013 and Summer 2015 Mobilizations)
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
HRGC/HRMS (PCB Congeners)	Tune using PFK	Prior to sample analysis	Resolving power ≥10,000 at m/z = 304.9824 or any other significant PFK fragment in the 300-350 range. The deviation between each monitored exact m/z and the theoretical m/z must be <5ppm	Retune instrument Reanalyze PFK	Vista Analytical Chemist	EPA Method 1668C
	6-Point Initial Calibration (ICAL)	Initially and as required	%RSD ±20% Ion ratios within Table 8 limits, and S/N ≥10	Evaluate system. Recalibrate.		
	Daily Continuing Calibration Verification (ICAL)	Once per 12 hours, prior to sample analysis	Compare recovery with calibration verification limit in Table 6. Ion ratios within Table 8 limits and S/N >10	Evaluate system. Reanalyze CCAL. Recalibrate (ICAL) as necessary.		

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23)

QAPP Worksheet #24-3 (November 2013 and Summer 2015 Mobilizations)
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
GC/HRMS (HCX)	Initial Calibration (5-point)	Whenever a new set of spiking calibration standards are created or whenever the continuing calibration falls outside the acceptance criteria	Signal to noise (S/N) ratio exceeds 10:1 for all ions monitored Ion abundance ratios are within ±15% of the theoretical ratio %RSD for the mean RFs must be within ±20% for the natives and ±35% for the internal standards	A new initial calibration curve must be prepared	Vista Analytical/ Chemist	Vista SOP #41
	Continuing Calibration	At the beginning of a 12-hour sequence	% Deviation recoveries must be 70-130% for the natives and 50-150% for the labeled compounds	Instrument must be recalibrated and the affected samples reanalyzed		
			Ion ratios must be within criteria listed in Table 1 S/N ratio must exceed 10:1 for all ions monitored	Reanalyze associated sample extracts		

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23)

QAPP Worksheet #24-4 (November 2013 and Summer 2015 Mobilizations)
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
LC/MS/MS (HCP)	Initial Calibration (5-point)	Whenever a new set of spiking calibration standards are created or whenever the continuing calibration falls outside the acceptance criteria	%RSD ±20 for natives and ±30 for internal standards	A new initial calibration curve must be prepared	Vista Analytical/ Chemist	Vista SOP #50
	Continuing Calibration	At the beginning of a 12-hour sequence	% Deviation recoveries must be 70-130% for the native and the labeled compound	Instrument must be recalibrated and the affected samples reanalyzed		

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23)

QAPP Worksheet #24-5 (November 2013 and Summer 2015 Mobilizations)
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
HRGC/HRMS (TCDT)	Tune using PFK	Prior to sample analysis	Resolving power ≥10,000 at m/z = 303.9016	Retune instrument Reanalyze PFK	Vista Analytical Chemist	Vista SOP #53
	6-Point Initial Calibration (ICAL)	Initially and as required	Ion ratios ±15% of the theoretical ratio, S/N >10:1, %RSD ±20% for natives and ±30% for internal standards	Evaluate system. Recalibrate.		
	Daily Continuing Calibration Verification (CCAL)	Once per 12 hours, prior to sample analysis	Analyte concentrations must be within the limits specified in Table 5 and ion ratios within limits in Table 3 of Vista SOP #53, S/N >10:1	Evaluate system. Evaluate data for usability. Reanalyze CCAL. Recalibrate (ICAL).		

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23)

QAPP Worksheet #24-6 (November 2013 Mobilization)
Analytical Instrument Calibration Table

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action (CA)	Person Responsible for CA	SOP Reference[1]
High purity germanium detector	Single Calibration Standard	Daily	Within control chart limits	Recount twice. If still out, conduct instrument maintenance	Outreach Analyst	RAD_04-11
	Instrument Calibration Blank	Daily	Result-error ≤sample detection limit (SDL)	Recount twice. Recalibrate		

[1]Specify the appropriate reference letter or number from the Analytical SOP References table (Worksheet #23)

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #25 (November 2013 Mobilization)
Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference [1]
HRGC/HRMS	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	Vista Analytical Chemist	NA
GC/HRMS	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	Vista Analytical Chemist	NA
LC/MS/MS	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	Vista Analytical Chemist	NA
High Purity Germanium Detector	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	Outreach Lab Chemist	NA

[1]Specify the appropriate reference letter or number from Analytical SOP References table (Worksheet #23)

QAPP Worksheet #25 (Summer 2015 Mobilization)
Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference [1]
HRGC/HRMS	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	Vista Analytical Chemist	NA
GC/HRMS	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	Vista Analytical Chemist	NA
LC/MS/MS	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	As per manufacturer's recommendations	Vista Analytical Chemist	NA

[1]Specify the appropriate reference letter or number from Analytical SOP References table (Worksheet #23)

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #26 (November 2013 Mobilization)
Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): Christopher Gussman/SERAS
Sample Packaging (Personnel/Organization): Christopher Gussman/SERAS
Coordination of Shipment (Personnel/Organization): Christopher Gussman/SERAS
Type of Shipment/Carrier: Fed-Ex to Vista Analytical and Outreach Laboratory
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Sample Custodian, Vista Analytical and Outreach Laboratory
Sample Custody and Storage (Personnel/Organization): SERAS TL, Christopher Gussman and Sample Custodian, Vista Analytical and Outreach Laboratory
Sample Preparation (Personnel/Organization): Laboratory Chemists, Vista Analytical and Outreach Laboratory
Sample Determinative Analysis (Personnel/Organization): Laboratory Chemists, Vista Analytical and Outreach Laboratory
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): Ship within 1 to 3 days to the respective laboratories.
Sample Extract/Digestate Storage (No. of days from extraction/digestion): All samples are to be extracted and analyzed within holding times mandated by each analytical method.
Biological Sample Storage (No. of days from sample collection): NA
SAMPLE DISPOSAL
Personnel/Organization: Sample Custodian, Vista Analytical and Outreach Laboratory
Number of Days from Analysis: As per subcontract laboratories defined procedures.

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #26 (Summer 2015 Mobilization)
Sample Handling System

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT
Sample Collection (Personnel/Organization): Christopher Gussman/SERAS
Sample Packaging (Personnel/Organization): Christopher Gussman/SERAS
Coordination of Shipment (Personnel/Organization): Christopher Gussman/SERAS
Type of Shipment/Carrier: Fed-Ex to Vista Analytical
SAMPLE RECEIPT AND ANALYSIS
Sample Receipt (Personnel/Organization): Sample Custodian, Vista Analytical
Sample Custody and Storage (Personnel/Organization): SERAS TL, Christopher Gussman and Sample Custodian, Vista Analytical
Sample Preparation (Personnel/Organization): Laboratory Chemists, Vista Analytical
Sample Determinative Analysis (Personnel/Organization): Laboratory Chemists, Vista Analytical
SAMPLE ARCHIVING
Field Sample Storage (No. of days from sample collection): Ship within 1 to 3 days to the respective laboratories.
Sample Extract/Digestate Storage (No. of days from extraction/digestion): All samples are to be extracted and analyzed within holding times mandated by each analytical method.
Biological Sample Storage (No. of days from sample collection): NA
SAMPLE DISPOSAL
Personnel/Organization: Sample Custodian, Vista Analytical
Number of Days from Analysis: , As directed by EPA, the samples will be archived either by the laboratory or EPA Region 2.

Worksheet Not Applicable (State Reason)

QAPP Worksheet #27 (November 2013 and Summer 2015 Mobilizations)
Sample Custody Requirements

Field Sample Custody Procedures (sample collection, packaging, shipment, and delivery to laboratory): Each sample container will be affixed with a label identifying the sample number, sample location, collection date, collection time, matrix, requested analysis, and preservative. Each sample container will be placed in a re-sealable clear plastic bag and stored in a cooler on wet ice after collection. Sample coolers/containers will be forwarded to the assigned laboratories under specific chain-of-custody (COC) forms, and shipped via overnight courier to laboratory personnel. Sample coolers will contain ample packing material and wet ice, and will be sealed with duct tape or strapping tape. Custody seals will be placed over openings to ensure cooler and sample integrity. At least two custody seals will be placed across the shipping containers to ensure sample integrity. EPA/ERT Scribe software will be used for sample management, as well as, generation of sample documentation, such as, labels and COC records. All COC records will be peer reviewed prior to shipment of samples in accordance with SERAS SOP # 4005, *Chain of Custody Procedures.* Samples will be shipped within 24-72 hours of sampling for next-day delivery under COC to the appropriate laboratory in accordance with SERAS SOP #2004, *Sample Packaging and Shipment.* Procedures outlined in SOP #2002, #2003, and #2004 will be applied (refer to Worksheet #21).
Laboratory Sample Custody Procedures (receipt of samples, archiving, disposal): A sample custodian at the subcontract laboratories will accept custody of the shipped samples. As applicable, the custodian will record the cooler temperature, and inspect the samples for discrepancies, proper non-chemical preservation and container integrity before forwarding the samples to the appropriate department for analysis. The laboratory manager will be notified of any problems. Disposal will be in accordance with the outside laboratory's disposal protocols.
Sample Identification Procedures: Each sample will be identified with a unique identification number at the time of collection as follows. An abbreviated letter designation consisting of two or three letters as identified on Worksheet #18 (e.g., ND = No Dredge Zone) followed by a three digit numerical sample number at each area (e.g., 001) and the depth will be assigned to each sample collected. For example, the second core collected at surface from the No-Dredge zone would be labeled as ND-002-0-0.5. For the waste cells, an abbreviated three letter designation (GWC for Givaudan and DWC for Diamond Alkali) will be used followed by a four digit depth interval. For example if a sample is collected from the Diamond Alkali waste cell at a depth interval of 10 to 12 feet, the sample will be identified as DWC-1012. A unique laboratory number will be assigned to each sample during receipt at the respective laboratories. The number will be listed on the label of every sample container collected at a given location. Procedures outlined in SOP #2002 will be applied (refer to Worksheet #21).
Chain-of-custody Procedures: Chain-of-custody records will be generated for all samples submitted for analysis using Scribe database software. Procedures outlined in SOP #4005 will be applied (refer to Worksheet #21).

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #28-1 (November 2013 and Summer 2015 Mobilizations)
QC Samples Table

Matrix	Sediment or Soil
Analytical Group	PCDD/PCDFs
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	EPA Method 1613B
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Vista Analytical
No. of Sample Locations	13

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
Internal Standards	Every sample, method blank & LCS	Within limits in Table 7 of EPA Method	1. Check chromatography for interferences, flag data. 2. Check S/N. If <10:1, re-extract sample. 3. If S/N >10:1, evaluate data usability. Check instrument and re-analyze extract if problem is found. 4. Re-extract and re-analyze affected samples.	Vista Analytical Chemist	Accuracy/ Bias	$^{13}C_{12}$-2378-TCDD	25-164 ng/mL
						$^{13}C_{12}$-2378-TCDF	24-169 ng/mL
						$^{13}C_{12}$-12378-PeCDD	25-181 ng/mL
						$^{13}C_{12}$-12378-PeCDF	24-185 ng/mL
						$^{13}C_{12}$-23478-PeCDF	21-178 ng/mL
						$^{13}C_{12}$-123478-HxCDD	32-141 ng/mL
						$^{13}C_{12}$-123678- HxCDD	28-130 ng/mL
						$^{13}C_{12}$-123789 HxCDD	32-141 ng/mL
						$^{13}C_{12}$-123478-HxCDF	26-152 ng/mL
						$^{13}C_{12}$-123678-HxCDF	26-123 ng/mL
						$^{13}C_{12}$-123789-HxCDF	29-147 ng/mL
						$^{13}C_{12}$-234678-HxCDF	28-136 ng/mL
						$^{13}C_{12}$-1234678-HpCDD	23-140 ng/mL

QAPP Worksheet #28-1 (November 2013 and Summer 2015 Mobilizations)
QC Samples Table

Matrix	Sediment or Soil
Analytical Group	PCDD/PCDFs
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	EPA Method 1613B
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Vista Analytical
No. of Sample Locations	13

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
						$^{13}C_{12}$-1234678-HpCDF	28-143 ng/mL
						$^{13}C_{12}$-1234789-HpCDF	26-138 ng/mL
						$^{13}C_{12}$-OCDD	17-157 ng/mL
						$^{13}C_{12}$-OCDF	17-157 ng/mL
						$^{37}Cl_4$-2378-TCDD	35-197 ng/mL
MB	1 per analytical batch not to exceed 20 field samples per matrix.	<RL	1. Reanalyze if carryover is suspected. 2. If any CDD/CDF >RL or one-third of the regulatory compliance level, then the analysis of samples is halted until the blank associated with the sample batch shows no evidence of contamination.	Vista Analytical Chemist	Accuracy/Bias (Contamination)	<RL	

QAPP Worksheet #28-1 (November 2013 and Summer 2015 Mobilizations)
QC Samples Table

Matrix	Sediment or Soil
Analytical Group	PCDD/PCDFs
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	EPA Method 1613B
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Vista Analytical
No. of Sample Locations	13

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
OPR	1 per analytical batch not to exceed 20 field samples per matrix	Within Table 6 of EPA Method 1613B	1. Review internal standards. 2. Evaluate data for usability 3. If LCS recoveries are > the upper control limits and the sample results are non-detect, no action is required. 4. If samples have hits >RL, re-extract and re-analyze affected samples.	Vista Analytical Chemist	Accuracy/Bias	2378-TCDD	6.7-15.8 ng/mL
						2378-TCDF	7.5-15.8 ng/mL
						12378-PeCDD	35-71 ng/mL
						12378-PeCDF	40-67 ng/mL
						23478-PeCDF	34-80 ng/mL
						123478-HxCDD	35-82 ng/mL
						123678-HxCDD	38-67 ng/mL
						123789-HxCDD	32-81 ng/mL
						123478-HxCDF	36-67 ng/mL
						123678-HxCDF	42-65 ng/mL
						123789-HxCDF	39-65 ng/mL
						234678-HxCDF	35-78 ng/mL
						1234678-HpCDD	35-70 ng/mL
						1234678-HpCDD	41-61 ng/mL
						1234789-HpCDF	39-69 ng/mL

QAPP Worksheet #28-1 (November 2013 and Summer 2015 Mobilizations)
QC Samples Table

Matrix	Sediment or Soil
Analytical Group	PCDD/PCDFs
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	EPA Method 1613B
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Vista Analytical
No. of Sample Locations	13

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
						OCDD	78-144 ng/mL
						OCDF	63-170 ng/mL
						$^{13}C_{12}$-2378-TCDD	20-175 ng/mL
						$^{13}C_{12}$-2378-TCDF	22-152 ng/mL
						$^{13}C_{12}$-12378-PeCDD	21-227 ng/mL
						$^{13}C_{12}$-12378-PeCDF	21-192 ng/mL
						$^{13}C_{12}$-23478-PeCDF	13-328 ng/mL
						$^{13}C_{12}$-123478-HxCDD	21-193 ng/mL
						$^{13}C_{12}$-123678-HxCDD	25-163 ng/mL
						$^{13}C_{12}$-123789-HxCDD	21-193 ng/mL
						$^{13}C_{12}$-123478-HxCDF	19-202 ng/mL
						$^{13}C_{12}$-123678-HxCDF	21-159 ng/mL
						$^{13}C_{12}$-123789-HxCDF	17-205 ng/mL
						$^{13}C_{12}$-234678-HxCDF	22-176 ng/mL
						$^{13}C_{12}$-1234678-HpCDD	26-166 ng/mL

QAPP Worksheet #28-1 (November 2013 and Summer 2015 Mobilizations)
QC Samples Table

Matrix	Sediment or Soil
Analytical Group	PCDD/PCDFs
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	EPA Method 1613B
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Vista Analytical
No. of Sample Locations	13

QC Sample:	Frequency/ Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria	
						$^{13}C_{12}$-1234678-HpCDF	21-158 ng/mL
						$^{13}C_{12}$-1234789-HpCDF	20-186 ng/mL
						$^{13}C_{12}$-OCDD	26-397 ng/mL
						$^{13}C_{12}$-OCDF	26-397 ng/mL
MS	1 per analytical batch not to exceed 20 field samples per matrix	%R = 50-150 (for native compounds only)	1. Review data for usability. 2. Narrate outliers.	Vista Analytical Chemist	Accuracy/Bias	%R = 50-150 (for native compounds only)	
MS/MSD	1 per analytical batch not to exceed 20 field samples per matrix	RPD ±20%	1. Review data for usability. 2. Narrate outliers.	Vista Analytical Chemist	Accuracy/Bias	RPD ±20%	
Field Duplicate	1 per 20 samples	NA	Document in final deliverable	SERAS TL	Precision	RPD ±35%	

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #28-2 (November 2013 and Summer 2015 Mobilizations)
QC Samples Table

Matrix	Sediment or Soil
Analytical Group	PCB Congeners
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	EPA Method 1668C
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Vista Analytical
No. of Decision Units	13

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Internal Standards	Every sample, method blank & LCS	^{13}C-Mono, Di, TriCB + ^{13}C-23'4'5-TetraCB (%R = 5-145) Remaining Tetra, Penta, Hexa, Hepta, Octa, Nona and DecaCBs (%R = 10-145)	1. Check chromatography for interferences, flag data. 2. Check S/N. If <10:1, re-extract sample. 3. If S/N >10:1, evaluate data usability. Check instrument and re-analyze extract if problem is found. 4. Re-extract and re-analyze affected samples.	Vista Analytical Chemist	Accuracy	^{13}C-Mono, Di, TriCB + ^{13}C-23'4'5-TetraCB (%R = 5-145) Remaining Tetra, Penta, Hexa, Hepta , Octa, Nona and DecaCBs (%R = 10-145)

QAPP Worksheet #28-2 (November 2013 and Summer 2015 Mobilizations)
QC Samples Table

Matrix	Sediment or Soil
Analytical Group	PCB Congeners
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	EPA Method 1668C
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Vista Analytical
No. of Decision Units	13

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MB	1 per analytical batch not to exceed 20 field samples per matrix.	<RL	1. Reanalyze if carryover is suspected. 2. If any congener >2x RL or one-third of the regulatory compliance level, then the analysis of samples is halted until the blank associated with the sample batch shows no evidence of contamination.	Vista Analytical Chemist	Accuracy/Bias (Contamination)	<RL

QAPP Worksheet #28-2 (November 2013 and Summer 2015 Mobilizations)
QC Samples Table

Matrix	Sediment or Soil
Analytical Group	PCB Congeners
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	EPA Method 1668C
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Vista Analytical
No. of Decision Units	13

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
OPR	1 per analytical batch not to exceed 20 field samples per matrix	%R = 60-135	1. Review internal standards. 2. Evaluate data for usability 3. If LCS recoveries are > the upper control limits and the sample results are non-detect, no action is required. 4. If samples have hits >RL, re-extract and re-analyze affected samples.	Vista Analytical Chemist	Accuracy/Bias	%R = 60-135

QAPP Worksheet #28-2 (November 2013 and Summer 2015 Mobilizations)
QC Samples Table

Matrix	Sediment or Soil
Analytical Group	PCB Congeners
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	EPA Method 1668C
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Vista Analytical
No. of Decision Units	13

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MS	1 per analytical batch not to exceed 20 field samples per matrix	%R = 50-150%	1. Review data for usability. 2. Narrate outliers.	Vista Analytical Chemist	Accuracy/Bias	%R = 50-150
MS/MSD	1 per analytical batch not to exceed 20 field samples per matrix	RPD ±20%	1. Review data for usability. 2. Narrate outliers.	Vista Analytical Chemist	Precision	RPD ±20%
Field Duplicates	1 per 20 samples	NA	Document in final deliverable	SERAS TL	Precision	RPD ±35%
Cleanup Recovery Standards	Each sample	%R = 10-145%	1. Use additional cleanup procedures. 2. Use smaller mass of sample	Vista Analytical Chemist	Accuracy/Bias	%R = 10-145%

QAPP Worksheet #28-3 (November 2013 and Summer 2015 Mobilizations)
QC Samples Table

Matrix	Sediment or Soil
Analytical Group	HCX
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	Vista SOP #41 Revision 2
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Vista Analytical
No. of Sample Locations	13

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Method Blank	1 per analytical batch not to exceed 20 field samples per matrix.	<RL or 10x lower than the concentration found in any sample in the analytical batch	Reextract and reanalyze if the associated method blank does not meet criteria	Vista Analytical Chemist	Accuracy/Bias (Contamination)	<RL or 10x lower than the concentration found in any sample in the analytical batch
OPR	1 per analytical batch not to exceed 20 field samples per matrix	%R = 50-150%	If the OPR is outside of these limits, then the sample and OPR will be re-extracted and analyzed.	Vista Analytical Chemist	Accuracy/Bias	%R = 50-150%
^{13}C-123789-HxCDF (Internal Standard)	Each MB, OPR and sample	%R = 25-150 %R = 30-140	Reanalyze to confirm, reextract and analyze or document in case narrative	Vista Analytical Chemist	Accuracy/Bias	%R = 25-150 (Samples/Blanks) %R = 30-140 (OPR)

QAPP Worksheet #28-3 (November 2013 and Summer 2015 Mobilizations)
QC Samples Table

Matrix	Sediment or Soil
Analytical Group	HCX
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	Vista SOP #41 Revision 2
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Vista Analytical
No. of Sample Locations	13

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
^{13}C-123789HxCDD (Cleanup Recovery Standard)	Each MB, OPR and sample	50%≤Area≤200%	Reanalyze to confirm, reextract and analyze or document in case narrative	Vista Analytical Chemist	Accuracy/Bias	50%≤Area≤200%
MS	1 per 20 samples of the same matrix	%R = 50-150	Document in case narrative	Vista Analytical Chemist	Accuracy/Bias	%R = 50-150
MS/MSD*	One per 20 samples of the same matrix	RPD ±-25%	Document in case narrative	Vista Analytical Chemist	Precision	RPD ±25%
Field Duplicate	1 per 20 samples	NA	Document in final deliverable	SERAS TL	Precision	RPD ±35%

QAPP Worksheet #28-4 (November 2013 and Summer 2015 Mobilizations)
QC Samples Table

Matrix	Sediment or Soil
Analytical Group	HCP
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	Vista SOP #50 Revision 1
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Vista Analytical
No. of Sample Locations	13

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MB	1 per analytical batch not to exceed 20 field samples per matrix.	<RL	Reextract and reanalyze if the associated method blank does not meet criteria	Vista Analytical Chemist	Accuracy/Bias (Contamination)	<RL
OPR	1 per analytical batch not to exceed 20 field samples per matrix	%R = 50-120%	If the OPR is outside of these limits, then the sample and OPR will be re-extracted and analyzed.	Vista Analytical Chemist	Accuracy/Bias	%R = 50-120%
Internal Standard	Each MB, OPR and sample	%R = 5-153 %R=5-168	Reanalyze to confirm, reextract and analyze or document in case narrative	Vista Analytical Chemist	Accuracy/Bias	%R = 5-153 (Samples/Blanks) %R=5-168
MS	1 per 20 samples of the same matrix	%R = 50-150	Document in case narrative	Vista Analytical Chemist	Accuracy/Bias	%R = 50-150
MS/MSD	One per 20 samples of the same matrix	RPD ±50%	Document in case narrative	Vista Analytical Chemist	Precision	RPD ±50%

QAPP Worksheet #28-4 (November 2013 and Summer 2015 Mobilizations)
QC Samples Table

Matrix	Sediment or Soil
Analytical Group	HCP
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	Vista SOP #50 Revision 1
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Vista Analytical
No. of Sample Locations	13

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Field Duplicate	1 per 20 samples	NA	Document in final deliverable	SERAS TL	Precision	RPD ±35%

QAPP Worksheet #28-5 (November 2013 and Summer 2015 Mobilizations)
QC Samples Table

Matrix	Sediment or Soil
Analytical Group	TCDT
Concentration Level	Low
Sampling SOP	SERAS SOP #2016
Analytical Method/ SOP Reference	Vista SOP #53
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Vista Analytical
No. of Sample Locations	13

QC Sample:	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
MB	1 per analytical batch not to exceed 20 field samples per matrix.	<RL	Reextract and reanalyze if the associated method blank does not meet criteria	Vista Analytical Chemist	Accuracy/Bias (Contamination)	<RL
OPR	1 per analytical batch not to exceed 20 field samples per matrix	%R = 67-158	If the OPR is outside of these limits, then the sample and OPR will be re-extracted and analyzed.	Vista Analytical Chemist	Accuracy/Bias	%R = 67-158%
Internal Standard ^{13}C-2,4,6,8-TCDT	Each MB, OPR and sample	%R = 25-164 %R = 20-175	Reanalyze to confirm, reextract and analyze or document in case narrative	Vista Analytical Chemist	Accuracy/Bias	%R=25-164% (Samples/Blanks) %R = 20-175 (OPR)
MS	1 per 20 samples of the same matrix	%R = 50-150	Document in case narrative	Vista Analytical Chemist	Accuracy/Bias	%R = 50-150
MS/MSD	One per 20 samples of the same matrix	RPD ±20%	Document in case narrative	Vista Analytical Chemist	Precision	RPD ±20%
Field Duplicate	1 per 20 samples	NA	Document in final deliverable	SERAS TL	Precision	RPD ±35%

QAPP Worksheet #28-6 (November 2013 Mobilization)
QC Samples Table

Matrix	Sediment
Analytical Group	Radionuclides Be^{7} & Cs^{137}
Concentration Level	Low/Medium (mg/kg)
Sampling SOP(s)	SERAS SOP #2016
Analytical Method/SOP Reference	Outreach SOP #RAD_04-11
Sampler's Name	C. Gussman
Field Sampling Organization	SERAS
Analytical Organization	Outreach Technologies
No. of Sample Locations	4

Lab QC Sample:	Frequency / Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator (DQI)	Measurement Performance Criteria
Laboratory Duplicates	5%	<20% RPD	If not within control chart limits, flag and report in case narrative	Gamma Spectroscopy Laboratory Technician	Precision	<20% RPD
Field Duplicates	5%	NA	Flag and report in Final Deliverable	SERAS TL	Precision	RPD ±35%
LCS	5%	%R = 80-120% or acceptance range set by vendor	Reanalyze LCS and all associated samples	Gamma Spectroscopy Laboratory Technician	Accuracy	%R = 80-120% or acceptance range set by vendor

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #29
Project Documents and Records Table

Sample Collection Documents and Records	On-site Analysis Documents and Records	Off-site Analysis Documents and Records	Data Assessment Documents and Records	Other
Chain of custody records Sample labels Custody seals Site Logbook Field Change Form (if necessary) GPS Records		Instrument run logs Sample extraction logs Preventative maintenance logs Instrument printouts Internal COC records Temperature logs Standard receipt logs Standard prep logs Data Reduction/Data Review records Analytical Results	Data Assessment Forms Data Validation Check Records	Trip Report Tech Memo (Summary Report) QAPP Work Plan (WP) Health & Safety Plan (HASP)

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #30 (November 2013 Mobilization)
Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Location/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number
Sediment	Dioxins/Furans	Low	See Worksheet 18	EPA 1613B	6 weeks (except TCDT) after receipt of samples	Vista Analytical Laboratory 1104 Windfield Way El Dorado Hills, CA 95762 Martha Maier 916-673-1520	NA
	PCB Congeners			EPA 1668C			
	HCX			Vista SOP #41			
	HCP			Vista SOP #50			
	TCDT			Vista SOP #53			
	Radiochemistry (Sediments Only)			RAD_04-11	4 weeks after receipt of samples	Outreach Technologies 311 N. Aspen Avenue Broken Arrow, OK Ron Eidson 918-251-2515	

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #30 (Summer 2015 Mobilization)
Analytical Services Table

Matrix	Analytical Group	Concentration Level	Sample Location/ID Numbers	Analytical SOP	Data Package Turnaround Time	Laboratory/Organization (Name and Address, Contact Person and Telephone Number)	Backup Laboratory/Organization (Name and Address, Contact Person and Telephone Number
Soil	Dioxins/Furans	Low	See Worksheet 18	EPA 1613B	6 weeks (except TCDT) after receipt of samples	Vista Analytical Laboratory 1104 Windfield Way El Dorado Hills, CA 95762 Martha Maier 916-673-1520	NA
	PCB Congeners			EPA 1668C			
	HCX			Vista SOP #41			
	HCP			Vista SOP #50			
	TCDT			Vista SOP #53			

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #31 (November 2013 Mobilization)
Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (Title and Organizational Affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (Title and Organizational Affiliation)
Laboratory Accreditation Audit	Every 2 years	External	NELAC accrediting agency	NJDEP	QA/QC Officer/Outreach Laboratory	Laboratory Manager/Outreach Laboratory	NELAC Accrediting Authority
Laboratory Accreditation Audit	Every 2 years	External	NELAC/ISO accrediting agency	CADOH A2LA	QA/QC Officer/Vista Analytical	Laboratory Director/Vista Analytical	NELAC/ISO Accrediting Authority

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #31 (Summer 2015 Mobilization)
Planned Project Assessments Table

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Actions (CA) (Title and Organizational Affiliation)	Person(s) Responsible for Monitoring Effectiveness of CA (Title and Organizational Affiliation)
Laboratory Accreditation Audit	Every 2 years	External	NELAC/ISO accrediting agency	CADOH A2LA	QA/QC Officer/Vista Analytical	Laboratory Director/Vista Analytical	NELAC/ISO Accrediting Authority

QAPP Worksheet #32 (November 2013 Mobilization)
Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Timeframe for Response
Field Observations/ Deviations from QAPP	Logbook	Chris Gussman, TL, SERAS	Immediately	Field Change Form	Chris Gussman, TL, SERAS	Within 24 hours of change
Peer Review	In the deliverable	Chris Gussman, TL, SERAS	Prior to deliverable due date	Comments directly in the deliverable	Chris Gussman, TL, SERAS	Prior to deliverable due date
Lab Performance Audits	Audit Report	Outreach Laboratory	Within 30 Days	Corrective Action Plan	Regulatory Agency	Within 30 Days
Lab Performance Audits	Audit Report	Vista Analytical	Within 30 Days	Corrective Action Plan	Regulatory Agency	Within 30 Days

QAPP Worksheet #32 (Summer 2015 Mobilization)
Assessment Findings and Corrective Action Responses

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Timeframe for Response
Field Observations/ Deviations from QAPP	Logbook	Chris Gussman, TL, SERAS	Immediately	Field Change Form	Chris Gussman, TL, SERAS	Within 24 hours of change
Peer Review	In the deliverable	Chris Gussman, TL, SERAS	Prior to deliverable due date	Comments directly in the deliverable	Chris Gussman, TL, SERAS	Prior to deliverable due date
Lab Performance Audits	Audit Report	Vista Analytical	Within 30 Days	Corrective Action Plan	Regulatory Agency	Within 30 Days

QAPP Worksheet #33
QA Management Reports Table

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
Technical Report	Monthly	20th of the month following performance period	Task Leader/SERAS	ERT Project Officer and WAM
QA Report	Quarterly	February, May, August, November	QA/QC Officer/SERAS	ERT Quality Coordinator and ERT Project Officer

QAPP Worksheet #34 (November 2013 Mobilization)
Verification (Step I) Process Table

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
Chain of Custody Record	Reviewed by Field Sampling Personnel in field, upon receipt of samples by the outside laboratories and Data Validation Group prior to final analytical report preparation	Internal/ External	SERAS TL Outreach Laboratory Vista Analytical SERAS QA/QC Chemist
Laboratory Data Package	Reviewed for measurement performance criteria	Internal/ External	Outreach Laboratory Vista Analytical SERAS QA/QC Chemist
Analytical Report	Reviewed for accuracy	Internal	SERAS QA/QC Chemist SERAS QA/QC Officer SERAS Program Manager
Trip Report	Reviewed for accuracy	Internal	SERAS Peer Review Team
Technical Memorandum (Summary Report)	Reviewed for accuracy	Internal	SERAS Peer Review Team
Completeness Check	Review of Planning Documents, Analytical Data Packages, Sampling Documents and External Reports, as applicable, using the UFP-QAPP checklist.	Internal	SERAS TL and QA/QC Group

QAPP Worksheet #34 (Summer 2015 Mobilization)
Verification (Step I) Process Table

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
Chain of Custody Record	Reviewed by Field Sampling Personnel in field, upon receipt of samples by the outside laboratories and Data Validation Group prior to final analytical report preparation	Internal/ External	SERAS TL Vista Analytical SERAS QA/QC Chemist
Laboratory Data Package	Reviewed for measurement performance criteria	Internal/ External	Vista Analytical SERAS QA/QC Chemist
Analytical Report	Reviewed for accuracy	Internal	SERAS QA/QC Chemist SERAS QA/QC Officer SERAS Program Manager
Trip Report	Reviewed for accuracy	Internal	SERAS Peer Review Team
Technical Memorandum (Summary Report)	Reviewed for accuracy	Internal	SERAS Peer Review Team
Completeness Check	Review of Planning Documents, Analytical Data Packages, Sampling Documents and External Reports, as applicable, using the UFP-QAPP checklist.	Internal	SERAS TL and QA/QC Group

QAPP Worksheet #35 (November 2013 Mobilization)
Validation (Steps IIa and IIb) Process Table

Step IIa/IIb	Validation Input	Description	Responsible for Validation (Name, Organization)
IIa	SOPs	Ensure that the sampling methods/procedures outlined in QAPP were followed, and that any deviations were noted/approved.	SERAS TL ERT WAM
IIb	SOPs	Determine potential impacts from noted/approved deviations, in regard to PQOs.	SERAS QA/QC Chemist
IIa	Chains of custody	Examine COC forms against QAPP and laboratory contract requirements (e.g., analytical methods, sample identification, etc.).	SERAS TL SERAS QA/QC Chemist
IIa	Laboratory data package	Examine packages against QAPP and laboratory contract requirements, and against COC forms (e.g., holding times, sample handling, analytical methods, sample identification, data qualifiers, QC samples, etc.).	Vista Analytical Lab Personnel Outreach Laboratory Personnel SERAS QA/QC Chemist SERAS TL
IIb	Laboratory data package	Determine potential impacts from noted/approved deviations, in regard to PQOs. Examples include PQLs and QC sample limits (precision/accuracy).	SERAS QA/QC Chemist SERAS QA/QC Officer

QAPP Worksheet #35 (Summer 2015 Mobilization)
Validation (Steps IIa and IIb) Process Table

Step IIa/IIb	Validation Input	Description	Responsible for Validation (Name, Organization)
IIa	SOPs	Ensure that the sampling methods/procedures outlined in QAPP were followed, and that any deviations were noted/approved.	SERAS TL ERT WAM
IIb	SOPs	Determine potential impacts from noted/approved deviations, in regard to PQOs.	SERAS QA/QC Chemist
IIa	Chains of custody	Examine COC forms against QAPP and laboratory contract requirements (e.g., analytical methods, sample identification, etc.).	SERAS TL SERAS QA/QC Chemist
IIa	Laboratory data package	Examine packages against QAPP and laboratory contract requirements, and against COC forms (e.g., holding times, sample handling, analytical methods, sample identification, data qualifiers, QC samples, etc.).	Vista Analytical Lab Personnel SERAS QA/QC Chemist SERAS TL
IIb	Laboratory data package	Determine potential impacts from noted/approved deviations, in regard to PQOs. Examples include PQLs and QC sample limits (precision/accuracy).	SERAS QA/QC Chemist SERAS QA/QC Officer

QAPP Worksheet #36 (November 2013 Mobilization)
Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (title and organizational affiliation)
IIb	Sediment	PCDDs/PCDFs + non 2,3,7,8-TCDD congeners	Low	SERAS SOP #1019, *Data Validation Procedures for Dioxin/Furan Analysis by HRGC/HRMS*	SERAS QA/QC Group
IIb	Sediment	PCB Congeners	Low	Draft SOP #1024, *Data Validation Procedures for PCB Congener Analysis Using HRGC/HRMS*	SERAS QA/QC Group
IIb	Sediment	Radiochemistry	Low	Draft SOP #1023, *Data Validation Procedures for Radiochemical Data*	SERAS QA/QC Group
IIb	Sediment	HCX	Low	Draft Data Assessment Form for Hexachloroxanthene (HCX) Data Review	SERAS QA/QC Group
IIb	Sediment	HCP	Low	Draft Data Assessment Form for Hexachlorophene (HCP) Data Review	SERAS QA/QC Group
IIb	Sediment	TCDT	Low	Draft Data Assessment Form for Tetrachlorodibenzothiophene Data Review	SERAS QA/QC Group

QAPP Worksheet #36 (Summer 2015 Mobilization)
Validation (Steps IIa and IIb) Summary Table

Step IIa/IIb	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (title and organizational affiliation)
IIb	Soil	PCDDs/PCDFs + TCDT	Low	SERAS SOP #1019, *Data Validation Procedures for Dioxin/Furan Analysis by HRGC/HRMS*	SERAS QA/QC Group
IIb	Soil	PCB Congeners	Low	Draft SOP #1024, *Data Validation Procedures for PCB Congener Analysis Using HRGC/HRMS*	SERAS QA/QC Group
IIb	Soil	HCX	Low	Data Assessment Form for Hexachloroxanthene (HCX) Data Review	SERAS QA/QC Group
IIb	Soil	HCP	Low	Data Assessment Form for Hexachlorophene (HCP) Data Review	SERAS QA/QC Group
IIb	Soil	HCP	Low	Data Assessment Form for Tetrachlorodibenzothiophene Data Review	SERAS QA/QC Group

☐ Worksheet Not Applicable (State Reason)

QAPP Worksheet #37
Usability Assessment

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used: See below.
Describe the evaluative procedures used to assess overall measurement error associated with the project: See below.
Identify the personnel responsible for performing the usability assessment: Assessment of data usability will be done by EPA Region 2 personnel, ERT WAM and SERAS Statistician.
Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies: Ratios of 2,4,6,8-TCDT to 2,3,7,8-TCDD or other ratios if analytes are expected to be useful for environmental forensics.

The following items will be assessed and conclusions drawn based on their results:

Holding Time: All sample data will be checked to verify that both sample preparation and analysis were performed within the method required holding time.
Calibration: Data associated with instrument calibration and verification of calibration will be reviewed to confirm that all data were generated using properly calibrated instrumentation.
Accuracy/Bias Contamination: Results for all laboratory method blanks and instrument calibration blanks will be checked against performance criteria specified in Worksheet # 28; results for analytes that exceed criteria will be identified and the impact on field sample data will be assessed. Data will be summarized by type of blank.
Accuracy/Bias Overall: Reported values of laboratory control samples, performance samples, and matrix spikes will be evaluated against the spiked or certified concentration and the percent recovery will be calculated and compared to the criteria specified in Worksheet #28. The percent recovery information will be used to assess the bias associated with the analysis. Recovery for matrix spikes in conjunction with the recovery reported for performance samples and laboratory control samples will provide information on the impact of the sample matrix on specific analyses. Average recoveries will be calculated and reported by analyte for each type of QC sample.
Precision: Results of the relative percent difference (RPD) will be calculated for each analyte in laboratory. These RPDs will be checked against measurement performance criteria presented on Worksheet #28; RPDs exceeding the stated criteria will be identified.
Sensitivity: Reporting limits will be checked against the criteria presented on Worksheet #15 and QLs presented on Worksheet #15.
Representativeness: A review of field records will be used to confirm that sample collection and handling was performed in a manner that conformed to the designated SOP. Similarly laboratory preparation procedures will be reviewed during validation to ensure that a representative sample was selected for analysis. Any deviations or modifications to field or laboratory procedures which might impact the representativeness of the sample will be discussed in the project final report.
Comparability: The sampling and analytical procedures which will be used in this program have been selected to ensure that the resulting data will be comparable to data from similar programs conducted previously or which will be conducted in the future. Any modifications or deviations from stated procedures which might impact data comparability will be addressed in the project final report.
Completeness: Completeness for the analytical program will be calculated as the number of data points that are accepted as usable based on the validation process divided by the total number of data points for each analysis.

FIGURE 1
Proposed Sampling Map
Diamond Alkali – Dioxin Investigation QAPP
May 2015

Map Creation Date: January 06, 2014

Coordinate system:
New Jersey StatePlane, NAD1083
FIPS 2900
Units: Feet

N
W E
S

0 500 1,000 Feet

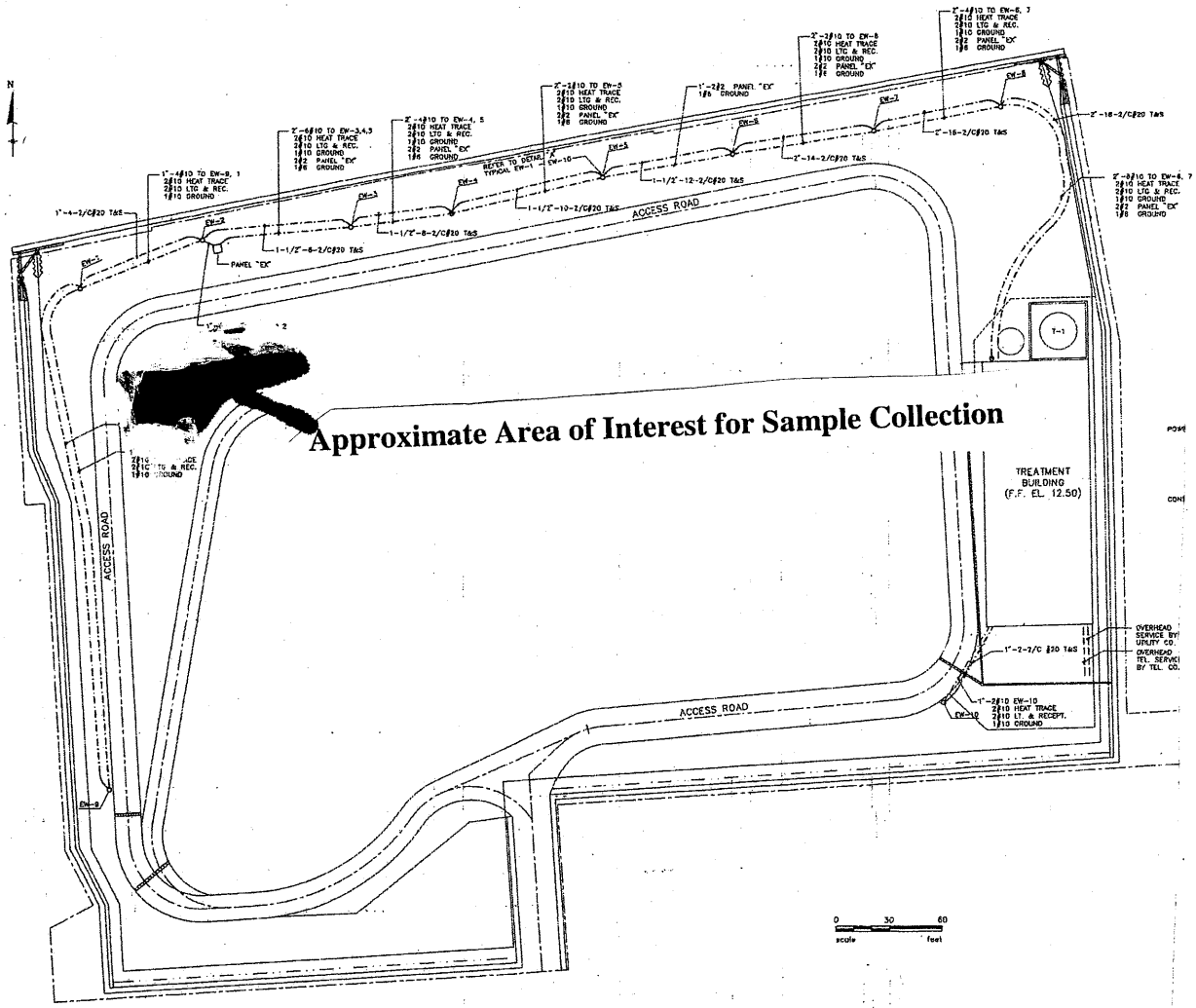
D R A F T

Data: g:\arcviewprojects\SERAS01\00-222
MXD file: g:\arcinfoprojects\SERAS01\SER00222_GIVAUDAN/\222_Vibracore_Sampling

U.S. EPA Environmental Response Team
Scientific Engineering Response and Analytical Services
EP-W-09-031
W.A.# 0-222

Figure 1
Sampling Locations
Passaic Sediments
RM 10.9 Investigation
Newark, NJ

FIGURE 2
Proposed Sampling Area for Diamond Alkali
Diamond Alkali – Dioxin Investigation QAPP
May 2015



REV	DESCRIPTION OF REVISION	BY	DATE

Diamond Alkali Superfund Site

80/120 Lister Avenue
Newark, New Jersey

MICHAEL D. MURAY P.A.
CONSULTING ENGINEERS
12-23 River Road, Fair Lawn, N.J. 07410
Tel: 201/794-1020 Fax: 201/794-9079

P.E. NAME, DATE AND SEAL
STATE LICENSE NO.
2/5/96

DESIGNED	REB
DRAWN	EM
CHECKED	MDM
PEER REVIEWED	
PROJECT MANAGER	MDM
DATE	2/96

80/120 LISTER AVENUE NEWARK, NEW JERSEY

SITE PLAN & DETAILS

REVISION
PROJECT
DRAWING E-1

APPENDIX A
Dioxins/Furans, PCB Congeners, HCX, HCP and TCDT Method Summaries
Diamond Alkali – Dioxin Investigation QAPP
May 2015

Vista Analytical Laboratory

Method Summary

Chlorinated Dioxins and Furans in Solid Matrix by EPA Method 1613

Method 1613 is used for the determination of chlorinated dioxins and furans in water, soil, sediment, biosolids, tissue, and other sample matrices by high resolution gas chromatography (HRGC)/high resolution mass spectrometry (HRMS). This method is "performance-based" and modifications are permitted to overcome interferences and improve sensitivity.

Samples must be extracted within one year of collection and analyzed within one year from extraction. All samples are kept at or below 4°C in the dark. A Method Blank and Ongoing Precision and Recovery (OPR) sample are prepared with every preparation batch of 20 samples or less per matrix type.

Samples are first spiked with Internal Standards (see below). The samples are soxhlet/Dean Stark extracted for 16 hours in toluene after percent solids determination. The extracts are then spiked with Clean-up Recovery Standard and tetradecane. The extracts are exchanged to hexane and concentrated to the tetradecane. Complex matrices may receive Acid Partition cleanup prior to Acid Base Silica Gel (ABSG) column cleanup. Column clean-up is performed by an ABSG column in tandem with an Acid Alumina (AA) column. A Florisil clean up column may be used if necessary. The eluate is concentrated and transferred to a vial containing Recovery Standard and tetradecane for HRMS analysis.

The analytes are separated by HRGC using a ZB-5MS column and detected by HRMS. An individual 2,3,7,8-substituted congener is identified by comparing the GC retention time and ion-abundance ratio of two exact m/z's with the corresponding retention time of an authentic standard and the theoretical ion-abundance ratio of the two exact m/z's. The instrument is tuned to the minimum required resolving power of 10,000 and the mass resolution check is achieved before any analysis is performed for each 12-hour analytical clock. A five-point initial calibration curve is analyzed to demonstrate the linearity of the HRMS system over the calibration range and verified with a continuing calibration verification standard per analytical batch. Quantitative analysis is performed using selected ion current profile (SICP) areas. Detection limits are sample and congener specific and are based on the signal to noise ratio. Concentrations of 2,3,7,8-TCDF at or above the low-point in the calibration curve are confirmed using a DB-225 GC column.

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(916) 673-1520
Fax (916) 673-0106

Labeled Standards

Internal Standards
^{13}C-2,3,7,8-TCDD
^{13}C-2,3,7,8-TCDF
^{13}C-1,2,3,7,8-PeCDD
^{13}C-1,2,3,7,8-PeCDF
^{13}C-2,3,4,7,8-PeCDF
^{13}C-1,2,3,4,7,8-HxCDD
^{13}C-1,2,3,6,7,8-HxCDD
^{13}C-1,2,3,4,7,8-HxCDF
^{13}C-1,2,3,6,7,8-HxCDF
^{13}C-1,2,3,7,8,9-HxCDF
^{13}C-2,3,4,6,7,8-HxCDF
^{13}C-1,2,3,4,6,7,8-HpCDD
^{13}C-1,2,3,4,6,7,8-HpCDF
^{13}C-1,2,3,4,7,8,9-HpCDF
^{13}C-OCDD
^{13}C-OCDF
Cleanup Recovery Standard
$^{37}Cl_4$-2,3,7,8-TCDD
Recovery Standards
^{13}C-1,2,3,4-TCDD
^{13}C-1,2,3,4-TCDF
^{13}C-1,2,3,4,6,9-HxCDF

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Vista Analytical Laboratory

Method Summary

Chlorinated Biphenyl Congeners in Solid Matrix by EPA Method 1668

Method 1668, Revision A is used for the determination of chlorinated biphenyl congeners in water, soil, sediment, biosolids, tissue, and other sample matrices by high resolution gas chromatography (HRGC)/high resolution mass spectrometry (HRMS). This Method is "performance-based" and modifications are permitted to overcome interferences and improve sensitivity.

Samples must be extracted within one year of collection and analyzed within one year from extraction. Aqueous and solid samples are kept at or below 6°C in the dark. A Method Blank and an Ongoing Precision and Recovery (OPR) sample are prepared with every preparation batch of twenty samples or less per matrix type.

Samples are first spiked with Internal Standard solution. The samples are soxhlet/Dean-Stark extracted for 16 – 24 hours in toluene after percent solids determination. The extracts are then spiked with Clean-Up Recovery standard, exchanged to hexane, and concentrated. The extracts are cleaned up using an Acid Base Silica Gel (ABSG) column using hexane, collecting all eluates. Complex matrices may receive Acid Partition cleanup. The eluate is concentrated and transferred to a vial containing Recovery Standard and nonane for HRMS analysis.

The analytes are separated by HRGC using a ZB-1 column and detected by HRMS. An individual PCB congener is identified by comparing the retention time and ion abundance ratio of two exact m/z's with the corresponding retention time of an authentic standard and the theoretical ion-abundance ratio of the two exact m/z's. Quantitative analysis is performed using selected ion current profile areas. The instrument is tuned to the minimum required resolving power of 10,000 and the mass resolution check is achieved before any analysis is performed for each 12-hour analytical clock. A six-point initial calibration curve of all congeners is analyzed to demonstrate the linearity of the HRMS system over the calibration range and verified with a continuing calibration verification standard per analytical batch. Quantitative analysis is performed using selected ion current profile (SICP) areas. Quantitation limits correspond to the concentration of the standard at the low point of the calibration curve. Detection limits are sample specific and congener specific and are based on the signal to noise ratio. Method enhancements include the analysis of an expanded list of internal standards for more accurate quantitation and congener identification.

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Fax (916) 673-0106

Internal Standards	Congener #
^{13}C-2-MonoCB	^{13}C-PCB-1
^{13}C-4-MonoCB	^{13}C-PCB-3
^{13}C-2,2'-DiCB	^{13}C-PCB-4
^{13}C-2,5-DiCB	^{13}C-PCB-9
^{13}C-3,3'-DiCB	^{13}C-PCB-11
^{13}C-2,2',6-Tri-CB	^{13}C-PCB-19
^{13}C-2,4,4'-Tri-CB	^{13}C-PCB-28
^{13}C-2,4',6-Tri-CB	^{13}C-PCB-32
^{13}C-3,4,4'-Tri-CB	^{13}C-PCB-37
^{13}C-2,2',4,4'-Tetra-CB	^{13}C-PCB-47
^{13}C-2,2',5,5'-Tetra-CB	^{13}C-PCB-52
^{13}C-2,2',6,6'-Tetra-CB	^{13}C-PCB-54
^{13}C-2,3',4',5-Tetra-CB	^{13}C-PCB-70
^{13}C-3,3',4,4'-Tetra-CB	^{13}C-PCB-77
^{13}C-3,4,4',5-Tetra-CB	^{13}C-PCB-80
^{13}C-3,3',4,4'-Tetra-CB	^{13}C-PCB-81
^{13}C-2,2',3,5',6-Penta-CB	^{13}C-PCB-95
^{13}C-2,2',3,4',5-Penta-CB	^{13}C-PCB-97
^{13}C-2,2',4,5,5'-Penta-CB	^{13}C-PCB-101
^{13}C-2,2',4,6,6'-Penta-CB	^{13}C-PCB-104
^{13}C-2,3,3',4,4'-Penta-CB	^{13}C-PCB-105
^{13}C-2,3,4,4',5-Penta-CB	^{13}C-PCB-114
^{13}C-2,3',4,4',5-Penta-CB	^{13}C-PCB-118
^{13}C-2',3,4,4',5-Penta-CB	^{13}C-PCB-123
^{13}C-3,3',4,4',5-Penta-CB	^{13}C-PCB-126
^{13}C-3,3',4,5,5'-Penta-CB	^{13}C-PCB-127
^{13}C-2,2',3,4,4',5'-Hexa-CB	^{13}C-PCB-138
^{13}C-2,2',3,4,5,5'-Hexa-CB	^{13}C-PCB-141
^{13}C-2,2',4,4',5,5'-Hexa-CB	^{13}C-PCB-153
^{13}C-2,2',4,4',6,6'-Hexa-CB	^{13}C-PCB-155
^{13}C-2,3,3',4,4',5-Hexa-CB	^{13}C-PCB-156
^{13}C-2,3,3',4,4',5'-Hexa-CB	^{13}C-PCB-157
^{13}C-2,3,3',4,5,5'-Hexa-CB	^{13}C-PCB-159
^{13}C-2,3',4,4',5,5'-Hexa-CB	^{13}C-PCB-167
^{13}C-3,3',4,4',5,5'-Hexa-CB	^{13}C-PCB-169
^{13}C-2,2',3,3',4,4',5-Hepta-CB	^{13}C-PCB-170
^{13}C-2,2',3,4,4',5,5'-Hepta-CB	^{13}C-PCB-180
^{13}C-2,2',3,4',5,6,6'-Hepta-CB	^{13}C-PCB-188
^{13}C-2,3,3',4,4',5,5'-Hepta-CB	^{13}C-PCB-189
^{13}C-2,2',3,3',4,4',5,5'-OctaCB	^{13}C-PCB-194
^{13}C-2,2',3,3',5,5',6,6'-OctaCB	^{13}C-PCB-202

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^{13}C-2,2',3,3',4,4',5,5',6-NonaCB	^{13}C-PCB-206
^{13}C-2,2',3,3',4,5,5',6,6'-NonaCB	^{13}C-PCB-208
^{13}C-Deca-CB	^{13}C-PCB-209
Cleanup Recovery Standards	
^{13}C-3,3',4,5'-Tetra-CB[1]	^{13}C-PCB-79
^{13}C-2,2'3,3'5,5'6-Hepta-CB[1]	^{13}C-PCB-178
Recovery Standards	
^{13}C-4,4'-Di-CB	^{13}C-PCB-15
^{13}C-2,4',5-Tri-CB	^{13}C-PCB-31
^{13}C-2,3,4,4'-Tetra-CB	^{13}C-PCB-60
^{13}C-2,3,3',5,5'-Penta-CB	^{13}C-PCB-111
^{13}C-2,2',3,3',4,4'-Hexa-CB	^{13}C-PCB-128
^{13}C-2,3,3',4,4',5,5',6-Octa-CB	^{13}C-PCB-205

Vista Analytical Laboratory

Method Summary

Hexachlorophene (HCP) in Soil and Sediment

The following procedure is used for the determination of Hexachlorophene (HCP) in soil, sediment, and other solid sample matrices by liquid chromatography/mass spectrometry (LC/MS/MS).

Samples must be extracted within one year of collection and analyzed within one year from extraction. All samples are kept at or below 6°C in the dark. A Method Blank and Ongoing Precision and Recovery (OPR) sample are prepared with every preparation batch of 20 samples or less per matrix type.

A 2-5 gram dry equivalent weight sample is spiked with Internal Standard (^{13}C-Hexachlorophene). Solid matrix samples are soxhlet/Dean Stark extracted for 16 - 24 hours in Hexane/Ethyl Acetate after percent solids determination.

The extract is cleaned up and concentrated through ion-exchange SPE. The eluate is concentrated, deionized water is added, and then transferred to a vial containing Recovery Standard (^{13}C-TCPAA) for LC/MS/MS analysis.

The extract is separated on a 100mm, 1.7µm C18 column using a gradient of NH_4OAc/AA buffer and acetonitrile/methanol. The HCP is identified by retention time compared to ^{13}C-Hexachlorophene using Multiple Reaction Monitoring (MRM). Tuning for HCP and associated internal standards is performed in electrospray negative ionization mode. The first MRM is used to quantify the analyte while the presence of the second MRM is used for confirmation. Only the quantitation ion is required for labeled compounds.

An initial five-point calibration curve is analyzed to demonstrate the linearity of the analytical system over the calibration range and verified with a continuing calibration verification standard per analytical batch. Quantitative analysis is performed using MRM areas.

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Method Summary

Hexachloroxanthene in Solid Matrix

The following procedure is used for the determination of 1,2,4,5,7,8-Hexachloroxanthene in soil, sediment, and other solid sample matrices by high resolution gas chromatography (HRGC)/high resolution mass spectrometry (HRMS).

Samples should be extracted within 14-days of collection and analyzed within 40-days from extraction. Samples should be kept at or below 4°C in the dark. A Method Blank and Ongoing Precision and Recovery (OPR) sample are prepared with every preparation batch of twenty samples or less.

After homogenization, approximately 10 grams of sample is added to an analyte-free thimble. The sample is spiked with Internal Standard (^{13}C-1,2,3,7,8,9-HxCDF) and soxhlet/Dean-Stark extracted for 16 hours in hexane/ethyl acetate. The extracts are spiked with Clean-Up Recovery standard (^{13}C-1,2,3,7,8,9-HxCDD), exchanged to hexane, and concentrated. Column clean-up is performed by an Acid Base Silica Gel column in tandem with an Acid Alumina column, followed by a Florisil column. The eluate is concentrated and transferred to a vial containing Recovery Standard (^{13}C-1,2,3,4,6,9-HxCDF), before being analyzed by HRGC/HRMS.

The 1,2,4,5,7,8-Hexachloroxanthene is separated by the HRGC using a ZB-5MS column and detected by HRMS. The analyte is identified by comparing the retention time and ion abundance ratio of two exact m/z's with the corresponding retention time of an authentic standard and the theoretical ion-abundance ratio of the two exact m/z's. Quantitative analysis is performed using selected ion current profile areas. The instrument is tuned to the minimum required resolving power of 10,000 and the mass resolution check is achieved before any analysis is performed for each 12-hour analytical clock. A six-point initial calibration curve is analyzed to demonstrate the linearity of the HRMS system over the calibration range and verified with a continuing calibration verification standard per analytical batch. Quantitative analysis is performed using selected ion current profile (SICP) areas. Quantitation limits correspond to the concentration of the standard at the low point of the calibration curve. Detection limits are sample specific and are based on the signal to noise ratio.

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Method Summary

2,4,6,8-Tetrachlorodibenzothiophene (TCDT) in Solid Matrix

The following procedure is used for the determination of 2,4,6,8-Tetrachlorodibenzothiophene (TCDT) in soil, sediment, and other solid sample matrices by high resolution gas chromatography (HRGC)/high resolution mass spectrometry (HRMS).

Samples must be extracted within one year of collection and analyzed within one year from extraction. All samples should be kept at or below 6°C in the dark. A Method Blank and Ongoing Precision and Recovery (OPR) sample are prepared with every preparation batch of 20 samples or less per matrix type.

Ten gram dry equivalent weight samples are first spiked with Internal Standard (^{13}C-2,4,6,8-TCDT). Solid matrix samples are soxhlet/Dean Stark extracted for 16 - 24 hours in toluene after percent solids determination. The extracts are then spiked with Clean-up Recovery Standard ($^{37}Cl_4$-2,3,7,8-TCDD). Column clean-up is performed by an Acid Base Silica Gel (ABSG) column in tandem with an Acid Alumina (AA) column, followed by a Florisil column. The eluate is concentrated and transferred to a vial containing Recovery Standard (^{13}C-1,2,3,4-TCDD) and tetradecane for HRMS analysis.

The analyte is separated by HRGC using a ZB-5MS column and detected by HRMS. Two exact m/z's are monitored for the analyte. The TCDT is identified by comparing the GC retention time and ion-abundance ratio of two exact m/z's with the corresponding retention time of an authentic standard and the theoretical ion-abundance ratio of the two exact m/z's. The instrument is tuned to the minimum required resolving power of 10,000 and the mass resolution check is achieved before any analysis is performed for each 12-hour analytical clock. An initial calibration curve is analyzed to demonstrate the linearity of the HRMS system over the calibration range and verified with a continuing calibration verification standard per analytical batch. Quantitative analysis is performed using selected ion current profile (SICP) areas. Detection limits are sample and congener specific and are based on the signal to noise ratio.

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APPENDIX B
Gamma Spectrometry Standard Operating Procedure
Diamond Alkali – Dioxin Investigation QAPP
May 2015

Outreach Laboratory

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Reaching
Beyond
the Standard

STANDARD OPERATING PROCEDURE

GAMMA SPECTROSCOPY

RAD_04-11

OUTREACH LABORATORY
02/28/13
REVISION 11

APPROVAL:

LABORATORY DIRECTOR — DATE 2/28/13

I acknowledge that I have read the revisions to SOP RAD_04-11.

APPROVALS:

NA

Jennifer Bledsoe Date

Stephen Debrah Date

2/28/13

Donna Eidson Date

2/28/13

Ron Eidson Date

Lori Eldridge 03042013

Lori Eldridge Date

NA

Mioto Johnson Date

NA

Kristie Nguyen Date

3/4/13

Ralph Terrell Date

3/4/13

Raymond Thomas Date

GAMMA SPECTROMETRY
TABLE OF CONTENTS

SAMPLE ANALYSIS BY GAMMA SPECTROMETRY

1.0 PURPOSE

This method describes the use of gamma spectroscopy for the measurement of gamma photons emitted from radionuclides without separating them from the sample matrix. The method can be applied to soil, water, air filters, etc. providing the sample can be condensed or reduced in size such that it can be placed in a calibrated geometry for counting.

2.0 DETECTION LIMIT

The detection limits for Cs-134 and Cs-137, which are 10 and 20 pCi/L respectively, are met with this procedure. Many other isotopes can be identified with this method and the detection limits are established by the customer or regulatory agency that governs the specific project.

3.0 SCOPE AND APPLICATION

3.1 Two types of gamma detectors are currently used, sodium iodide crystal, NaI, and high purity germanium detector, HPGe. Because of its energy resolution advantage and the availability of large active volume detectors, a HPGe detection system is used for measuring gamma emitting radionuclides.

3.2 The method is applicable for analyzing aqueous, non-aqueous, and solids samples that contain radionuclides emitting gamma photons with energies ranging from about 55 to 2000 keV.

4.0 SUMMARY OF METHOD

Solid samples are mixed as well as possible in their as-received containers. Liquid samples are shaken immediately before being transferred to the counting container. No other sample processing is done except to transfer to a suitable container (or plate) for counting.

A portion of the as-received or dried and ground sample is placed in a container such as a poly-bottle or marinelli beaker for which a calibration exists. An intrinsic germanium detector, interfaced with an 8192-channel multichannel analyzer controlled by Canberra Genie 2000 software is used to acquire and analyze the gamma spectrum. Data is then corrected for background.

5.0 DEFINITIONS

5.1 Accuracy – The closeness of agreement between an observed value and an accepted value.

5.2 Batch – A group of samples which behave similarly with respect to the sampling or the testing procedures being employed and which are processed as a unit.

5.3 Bias – the deviation due to matrix effects of the measured value from a known spiked amount.

5.4 Matrix Duplicate – An intralaboratory split sample which is used to document the precision of a method in a given sample matrix.

5.5 Matrix – The component or substrate which contains the analyte of interest; ie: surface water, drinking water, or soil.

5.6 Method Detection Limit – The minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero.

5.7 Precision – The agreement among a set of replicate measurements without assumption of knowledge of the true value. Precision is estimated by means of duplicate/replicate analyses.

5.8 MAPEP – The United States Department of Energy *Mixed Analyte Performance Evaluation Program.*

6.0 INTERFERENCES

6.1 Interferences are minimal in this method due to the high resolution of the intrinsic germanium detector.

6.2 Naturally occurring radionuclides found in building components may result in the background peaks not truly in the sample. These are corrected during the data reduction process.

7.0 SAFETY PRECAUTIONS

7.1 Hazardous Chemicals/Equipment

All work is to be performed in a fume hood with the following chemicals, 1) nitric acid, concentrated, and 2) hydrofluoric acid.

7.2 Radiological Hazards
When working with radioactive materials that are capable of being volatilized or airborne, perform activities in a fume hood.

7.3 General Laboratory Safety

Refer to the Laboratory Chemical Hygiene Plan for general laboratory safety.

8.0 EQUIPMENT AND SUPPLIES

8.1 Marinelli beakers: 1.0and 2.0-L.

8.2 Graduated cylinders: 1.0 and 2.0-L.

8.3 Poly-bottles and poly-containers: 160 & 500 mL.

8.4 Petri dishes: 50mm, 95mm and 100mm plastic disposable

8.5 Spatula.

8.6 Electric or duct tape.

8.7 Analytical balance.

8.8 High purity germanium detector with shield.

8.9 Spectroscopy amplifier.

8.10 High voltage supply.

8.11 Multichannel analyzer: 4096 channels, equipped with Computer with printer and Genie 2000 application software.

8.12 90 mm or 47mm / 0.45 μm membrane filter

8.13 Filtration System

8.14 Pestle and mortar

8.15 12 and 60 mesh sieve

8.16 Liquid Nitrogen – Nitrogen Service

8.17 ½ inch porcelain ball grinding media, Fisher # 08-400A or equivalent.

8.18 Tumbler – Rotary Extractor – capable of rotating extraction vessels in an end-over-end fashion.

9.0 REAGENTS AND STANDARDS

NOTE: All chemicals used for reagents are ACS or equivalent.

9.1 Deionized Water.

9.2 Sand-method blank

9.3 Calibration Standards – NIST or equivalent

	Source #	Geometry	Wt/Vol
9.3.1	R497-B1	**B1** - 160ml bottle	241g
9.3.2	R497-C1	**C1** -500ml container	624g
9.3.3	R497-M1	**M1**-1L marinelli	1 L
9.3.4	R497-M2	**M2**-2L Marinelli	2 L
9.3.5	R497-P1	**P1** (50 mm petri dish)	32g
9.3.6	R497-P2	**P2** (100 mm petri dish)	147g
9.3.7	R497-P3	**P3** (100 mm petri dish)	85.6g
9.3.8	I129-3622-SS	**M500**-500 mL marinelli	500 ml (I129)

10.0 SAMPLE COLLECTION AND PRESERVATION

10.1 Samples should be collected and stored in plastic rather than glass to prevent loss due to breakage during transportation and handling.

10.2 Samples should be preserved at the time of collection with nitric acid to the pH of 2 or less. If samples are to be collected without preservation, they should be brought to the laboratory within 5 days and then preserved and held in the original container for a minimum of 16 hours before analysis or transfer of the sample. Samples do not require refrigeration.

Note: If soluble or insoluble analysis is requested do not preserve.

10.3 Care should be taken during shipment of samples to avoid a contaminating spillage or cross contamination of multiple samples.

11.0 QUALITY CONTROL

11.1 Sample Quality Control

11.1.1 Prepare a lab control standard and a duplicate for each batch of up to twenty like samples. A method blank is to be counted if requested by client.

11.1.2 Blanks are prepared using sand for solid matrices and reagent water for aqueous matrices.

11.2 Instrument Quality Control

11.2.1 Count a background check for 1800 seconds or longer on each detector each day it is in use or with each sample batch.

11.2.2 Count a 60,000 second blank monthly, at a minimum, for each matrix analyzed to be used for background correction.

11.2.3 Count the appropriate check source for sample geometry for a minimum of 300 seconds on each detector each day the detector is in use. The B1 source check is used to monitor detector stability.

11.2.4 Upload data into QA file to evaluate source check. Print out and place in data gamma spec. run file.

B1 - 59, 662, 1173, and 1332
C1 - 59 or 88, 662, 1173, and 1332
P1-P3 – 59 or 88, 662, 1173, and 1332
M1-M2– 59 or 88, 662, 1173, and 1332

ALL ENERGY LINES SELECTED FOR DETECTOR MUST PASS

11.3 Corrective Action

11.3.1 Nonconformances may occur at any level. Some may be corrected immediately and documented using normal laboratory document procedures. Out-of-control nonconformances shall be documented by the use of a Corrective Action Report. With the use of a CAR, findings can be tracked and used to detect future trends.

11.3.2 Work shall be stopped when out-of-control deficiencies occur until the problem is alleviated, ie., instrumentation malfuntion, QC out of control limits, failure to perform demonstration of capabilities, etc.

12.0 CALIBRATION

Note: Calibration is performed on each spectrometer system at least annually, at a minimum, on each geometry in which measurements will be made.

12.1 Determine which calibration standard needs to be used and place in appropriate detector.

12.2 Acquire spectrum following steps 13.3.

12.3 Save Calibration with the following format:

XXZZMMDD.MCA

where XX = the detector number
ZZ = a geometry description (e.g., MI is a 1 L marinelli beaker).
MM = Month
DD = Day

12.4 Select from the **Calibration** Menu.

12.5 Select **Full Energy Calibration** from the Calibration Menu and select appropriate geometry. (KeV ≈ 0.5 per channel, Full width half max, FWHM, < 3.0 for Co-60 at 1173 KeV).

12.6 Select **Full Efficiency** from the Calibration Menu and select appropriate geometry.

12.7 Save the sample data using the following format:

ZZMMDDYY.CAL

where ZZ = a geometry description (e.g., M1 is a 1 L marinelli beaker).
MM = Month
DD = Day
YY = Year

12.8 Repeat for each detector and calibration source.

13.0 PROCEDURE

Note: If a detector has been out of service (e.g., thermocycle), do not apply bias across the detector unless it has been sufficiently cooled to liquid nitrogen temperatures overnight.

13.1 Water Sample Preparation

13.1.1 Measure 0.1, 0.5, 1.0 or 2.0 L of a sample and transfer into the appropriate sized marinelli beaker. Aliquot depends on sample available, but 1.0 or 2.0 L is

preferable. If less than 1 liter sample needs to be diluted to 1 liter with deionized water. Record volumes in the Sample Process Log.

Note: If soluble and insoluble are requested filter the sample through a 90 or 47 mm/0.45 µm pore size filter. Transfer filtrate to an appropriate sized marinelli beaker and save filter for analysis. Place filter in labeled Ziploc bag.

13.1.2 Place a lid on the container and seal it with tape. Apply label supplied from Sample Receiving showing the new Sub-ID.

13.1.3 Transfer the container to the counting room for analysis.

13.2 Soil or Sludge Sample Preparation

Note: If sample does not require drying and grinding, skip to step 13.2.9.

SOP WET_24 provides more detail regarding solid prep procedures.

13.2.1 Weigh sample before putting in oven. Record in Sample Process Log.

13.2.2 Dry sample at 100°C for at least 16 hours. If Beryllium-7 is requested, sample must be dried at no more than 70°C due to its volatility.

13.2.3 Weigh sample again after taking out of oven. Record in Sample Process Log.

13.2.4 Grind the sample in an exhaust hood and pass through a 12 or 60 mesh sieve.

13.2.5 Place well mixed sample into appropriate container. Fill the container full with sample depending on the volume of sample available and cap the bottle or container and seal with tape.

If there is not enough sample to fill a 160ml bottle, a petri dish (P1-P3) may be used. Solid samples should be compacted as well as possible to eliminate channels and air pockets.

13.2.6 Weigh the filled sample bottle subtracting the bottles tare weight.

13.2.7 Record all actions in the Sample Process Log.

13.2.8 Apply label supplied from Sample Receiving to sample.

13.2.9 Place sample in a plastic bag prior to counting to prevent contamination on the detector.

13.2.10 Transfer the sample to the counting room for analysis.

13.3 Data Acquisition

13.3.1 Record the detector number, sample identification number, volume, count date and geometry in the gamma spec log book.

13.3.2 Place the samples in the appropriate detector cavities and close the shield lids.

13.3.3 Preset the appropriate counting time using the **MCA-Aquire setup** keys. Liquid samples are typically counted for 500 minutes (30,000 sec) and solid samples are typically counted for 100 minutes (6000 sec). Counting times may be lengthened or shortened depending on required minimum detectable activities (MDA).

13.3.4 Clear any previous spectra on the screen by selecting the clear button on the screen. (Be sure previous spectra have been stored prior to erasing.)

13.3.5 Acquire the sample spectra by selecting the **Start** button on the screen. Select **Edit** from the top menu and enter sample information. Enter data in the appropriate fields.

13.3.6 Save the acquired spectra individually. This is accomplished by selecting **File** then **Save**. Save the sample using the following format:

The filename has the following format:

XXZZZZSS.CNF

where
XX = the detector number. ie., Detector 1 – 01
ZZZZ = the unique batch number assigned to the samples.
SS=sample sub id

13.3.7 Detectors may be operated independently by following steps 13.3.1 through 13.3.5.

13.4 Spectral Data Reduction

13.4.1 Select **Analyze** from the top menu.

13.4.2 Select from the Macro for detector analysis being performed on.

13.4.3 Select from File Menu-**Print Listing.**

13.4.4 Save the sample data using the following format:

The filename has the following format:

XXZZZZSS.CNF

where XX = the detector number. ie., Detector 1 – 01
ZZZZ = the unique batch number assigned to the samples.
SS=sample sub id

13.5 Data Collection

Document the data in a bound lab notebook for each set of analyses performed. Entries must be made at the time of analysis and include the following:

- description of activity being documented (e.g., "gamma Spec Analysis") and procedure being followed.
- Date analysis started and analyst(s) initial(s).
- count length.
- Outreach batch number, sample ID, count time and sample aliquot. Identify any lab quality control samples (LCSs).

13.6 Data Reduction and Reporting for Gamma Spec

Using the Canberra Genie 2000, report gamma spectroscopy scan data as follows:

Report each nuclide that the data system has identified and quantified to two significant figures along with the counting uncertainty rounded to two significant figures with the following provisos:

- Report only those nuclides positively identified and quantified by the Canberra program.

In evaluating the identification made by the software, consider the following:

- Agreement of results for multiple photon peaks of a given nuclide.
- Possible identifications of any unidentified peaks.
- Possibility that identified nuclides may actually be low abundance peaks of other nuclides found in the sample that have not been included in the libraries.

Document and support changes to automated nuclide identifications on the instrument printout.

- Do not report a lower order of magnitude (decimal place) in the uncertainty than will be reported in the activity.

  Examples:

  176 +/- 32.1 pCi/L is reported as 176 +/- 32
  176 +/- 8.7 pCi/L is reported as 176 +/- 9

- If the counting uncertainty is greater than the reported activity, do not report the nuclide as found. (Unless requested by customer.)

- If no nuclides are identified by the data system, report "ND" in the results column of the LIMS data entry screen and "ND = Not detected" in the Value Text field of the data entry screen.

13.7 Data Reduction and Reporting for Specific Target Nuclides

If a specific nuclide is listed as an analyte in the LIMS and it was identified and quantified by the data system, report it as described above. If the specific nuclide is not identified and quantified by the data system, report the minimum detectable activity (MDA) for those nuclides as calculated by the data system. Report MDA values to one significant figure.

Qualify results for soil samples as follows: "Samples were oven-dried at 103°C prior to analysis. Nuclides volatile at this temperature are, therefore, excluded from analysis."

14.0 CALCULATIONS

The Genie 2000 software calculates the data using programs provided by Canberra and takes into account many variables. If Outreach calculates manually these are the equations used.

$$\text{ACTIVITY} = \frac{(CPM_{sample} - CPM_{bkgd})}{R*V*E*D*2.22}$$

$$\text{ERROR} = 1.96*SQRT\left(\frac{CPM_{sample}}{T_{sample}} + \frac{CPM_{bkgd}}{T_{bkgd}}\right)$$

R*V*E*D*2.22

$$MDR = 4.65*SQRT(CPM_{bkgd}) + \frac{2.71}{T}$$

$$MDA/MDC = \frac{MDR}{R*V*E*D*2.22}.$$

T	=	Count time
R	=	Chemical or Tracer recovery
V	=	Sample Volume or Weight
E	=	Efficiency
2.22	=	Conversion from dpm to pCi
D	=	Radionuclide decay factor $e^{-\lambda t}$

15.0 METHOD PERFORMANCE

15.1 Method performance is established by the use of demonstration of capability documentation. Performance evaluations by way of *QAP* and/or *MAPEP* are performed to track ongoing competency.

15.2 Method Detection Limits may be established but will vary due to sample matrices as well as concentration of particular isotopes found in the sample(s).

16.0 POLLUTION CONTROL

Refer to the Laboratory Chemical Hygiene Plan, SOP# GEN_22, for laboratory pollution control.

17.0 DATA ACCEPTANCE CRITERIA

Calibration/QC Sample	Frequency	Acceptance Criteria	
Instrument Calibration Standard	Daily	Control chart ± 3 sigma	Recount twice, if not in control limits place detector on hold for maintenance
Instrument Calibration Blank	Daily	Result-error ≤ SDL	Recount twice, if not in control limits, place detector on hold for maintenance
Laboratory Control Standard (LCS)	5%	80 – 120% or acceptance range by vender.	Reanalyze LCS and all associated samples
Duplicate	5%	< 20 RPD	If not in control limits, flag and report in case narrative

18.0 EQUIPMENT/INSTRUMENT MAINTENANCE & TROUBLESHOOTING

Maintenance is outlined in SOP GEN 17.

19.0 WASTE MANAGEMENT

Refer to SOP #GEN_19 (Hazardous Material Management) and SOP #GEN_20 (Waste Disposal) for laboratory waste management.

20.0 REFERENCES

20.1 Canberra Genie 2000 Software Operating Instructions.

20.2 Canberra QA S505 Software.

20.3 Environmental Protection Agency (EPA) Method 901.1.

20.4 Los Alamos National Laboratory (LANL) Method WR140-5.

20.5 DOE HASL 300, 4.5.2.3 Ga-01-R.

20.6 ANSI N42.14-1991, Calibration and Use of Germanium Spectrometers for the Measurement of Gamma-Ray Emission Rates of Radionuclides, American National Standards Institute, 1991.

20.7 DoD Quality Systems Manual Version 4.2, 10/25/10

21.0 ATTACHMENTS

21.1 Gamma Spec Run Log

21.2 Gamma Spec Data Checklist

21.3 Sample Process Log

SERAS Work Assignment Field Change Form

(must be completed to initiate any on-site change in the scope of a Work Assignment)

Date: 08/18/15	**Time:** 12:35	**Location:** CLIFTON, NJ
Work Assignment #: 222	**Person Initiating Change:** SERAS PERSONNEL & LSRP	
Work Assignment Title: DIAMOND ALKALI - DIOXIN INVESTIGATION		
Original Scope Being Changed (e.g., Work Assignment requests 5 samples): Accessing GIVAUDAN cell by hand digging.		
Changed Scope (e.g., WAM requests 30 samples): USING AN AIR KNIFE TO DIG DOWN TO MEMBRANES - JACKHAMMER RENTED FOR SURFACE ASPHALT.		
Reason for Changed Scope: * MATERIAL AT MUCH GREATER DEPTH THAN ANTICIPATED. ~60" BELOW SURFACE		
Task Leader Signature/Date:		
Work Assignment Manager Signature/Date: 8/13/15		
Other Applicable Signature(s)/Date:		

cc: EPA Work Assignment Manager
Kevin Taylor, SERAS Program Manager
Deborah Killeen, SERAS QA/QC Officer
Richard Leuser, Deputy Program Manager

Please note: 1) Additional resources (hours and/or dollars) may be required to fulfill the requested change in scope, 2) the schedule and milestones for this project as well as other projects may be modified as a result of the requested change in scope, and 3) these requirements/changes will be communicated in writing to the WAM as soon as a resource evaluation is made.

SERAS Work Assignment Field Change Form

(must be completed to initiate any on-site change in the scope of a Work Assignment)

Date: 8/18 - 8/20/15	**Time:**	**Location:** Diamond Alkali Cell (Lister Ave. Newark, NJ)
Work Assignment #: 222	**Person Initiating Change:** TIERRA/EUGENIA (EPA/RPM) w/TIERRA Phone call + e-mail on 7/9/15.	

Work Assignment Title:

DIAMOND ALKALI - DIOXIN INVESTIGATION

Original Scope Being Changed (e.g., Work Assignment requests 5 samples):

LOCKHEED MARTIN WILL DIG DOWN TO SURFACE NONWOVEN GEOTEXTILE (6" STONE) MEMBRANE. HOLE WILL BE GROUTED TO THIS MEMBRANE TO PREVENT LATER CROSS-CONTAMINATION. THIS ONE membrane will be patched and STONE RETURNED

Changed Scope (e.g., WAM requests 30 samples):

SAME SURFACE MEMBRANE ADDRESSED ALONG WITH THE 60-mil HDPE MEMBRANE AND those DIRECTLY PARALLEL + ADJOINING THIS 60-mil HDPE. THIS HDPE will be tested after patching to ensure its integrity + function. This requires subcontracting experts in the field of laying these membranes

Reason for Changed Scope: MAINTAIN INTEGRITY of CELL

Task Leader Signature/Date: 8/13/15

Work Assignment Manager Signature/Date: 8/13/15

Other Applicable Signature(s)/Date:

cc: EPA Work Assignment Manager
Kevin Taylor, SERAS Program Manager
Deborah Killeen, SERAS QA/QC Officer
Richard Leuser, Deputy Program Manager

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SERAS Work Assignment Field Change Form

(must be completed to initiate any on-site change in the scope of a Work Assignment)

Date: 8/13/15	**Time:**	**Location:** SAMPLE LOCATION GWC-2
Work Assignment #: 222	**Person Initiating Change:** EUGENIA AND STEVE BLAZE IN CONSULTATION W/ GIVAUDAN REPS	
Work Assignment Title: DIAMOND ALKALI - DIOXIN INVESTIGATION		
Original Scope Being Changed (e.g., Work Assignment requests 5 samples): INSTEAD OF DIGGING DOWN TO THE GEOTEXTILE MEMBRANE AT THE SECOND LOCATION AND PATCHING THIS MEMBRANE, ONLY SURFACE ASPHALT WILL BE REMOVED. THE GEOPROBE WILL BE USED TO COLLECT SAMPLE AND THE HOLE GROUTED. TH		
Changed Scope (e.g., WAM requests 30 samples): SEE ABOVE. ONLY REMOVING SURFACE ASPHALT AT SECOND LOCATION (GWC-2) AND GEOPROBING / GROUTING FROM there		
Reason for Changed Scope: CELL SPECS NOT AS APPEARED IN DIAGRAM. MEMBRANE >60" BELOW SURFACE. ASPHALT THICKER THAN ANTICIPATED		
Task Leader Signature/Date: 8/13/15		
Work Assignment Manager Signature/Date: 8/13/15		
Other Applicable Signature(s)/Date:		

cc: EPA Work Assignment Manager
Kevin Taylor, SERAS Program Manager
Deborah Killeen, SERAS QA/QC Officer
Richard Leuser, Deputy Program Manager

Please note: 1) Additional resources (hours and/or dollars) may be required to fulfill the requested change in scope, 2) the schedule and milestones for this project as well as other projects may be modified as a result of the requested change in scope, and 3) these requirements/changes will be communicated in writing to the WAM as soon as a resource evaluation is made.